

CHAPTER 13. MANUFACTURER IMPACT ANALYSIS

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CHAPTER 13. MANUFACTURER IMPACT ANALYSIS

13.1 INTRODUCTION

In determining whether a standard is economically justified, the U.S Department of Energy (DOE) is required to consider “the economic impact of the standard on the manufacturers and on the consumers of the products subject to such a standard.” (42 U.S.C. 6313(a)(6)(B)(i)) The law also calls for an assessment of the impact of any lessening of competition as determined in writing by the Attorney General. *Id.* DOE conducted a manufacturer impact analysis (MIA) to estimate the financial impact of higher energy conservation standards on manufacturers of cooking products and to assess the impact of such standards on employment and manufacturing capacity. The MIA has both quantitative and qualitative aspects.

The quantitative part of the MIA primarily relies on Government Regulatory Impact Models (GRIMs), industry-cash-flow models adapted for each product in this rulemaking. The GRIM inputs include information on industry cost structure, shipments, and pricing strategies. The GRIM’s key output is the industry net present value (INPV). The model estimates the financial impact of higher energy conservation standards for each product by comparing changes in INPV between a base case and the various trial standard levels (TSLs). The qualitative part of the MIA addresses factors such as product characteristics, characteristics of particular manufacturers, and market and product trends. It also assesses the impact of standards on subgroups of manufacturers.

For the notice of proposed rulemaking (NOPR), DOE considered new energy conservation standards for conventional cooking products (cooktops, ovens, and ranges) and microwave ovens. DOE also considered amended energy conservation standards for commercial clothes washers and new standby power standards for microwave ovens. As discussed in the final rule notice accompanying this technical support document (TSD), only new energy conservation standards for conventional cooking products and microwave ovens are addressed in this chapter.

13.2 METHODOLOGY

DOE conducted the MIA in three phases. Phase I, “Industry Profile,” consisted of preparing an industry characterization for the cooking product industries, including data on market share, sales volumes and trends, pricing, employment, and financial structure. Phase II, “Industry Cash Flow,” focused on the cooking product industries individually. Two major product categories are addressed in this TSD:

- Conventional cooking products, consisting of cooktops, standard ovens, self-cleaning ovens, and ranges fueled by either gas or electricity
- Microwave ovens

DOE developed two separate GRIMs to prepare an industry cash flow analysis for the industry of each product category. Using publicly available information developed in Phase I,

DOE adapted each GRIM's generic structure to facilitate analysis of new standards for each category of cooking products.

In Phase III, "Sub-Group Impact Analysis," DOE interviewed manufacturers representing 25 to 82 percent of unit shipments of cooking products, depending on the specific product category. This group included both large and small manufacturers, providing a representative cross-section of the industries. During these interviews, DOE discussed financial topics specific to each manufacturer and obtained each manufacturer's view of the industry as a whole. The interviews provided valuable information that DOE used to evaluate the impacts of new standards on manufacturers' cash flows, investment requirements, and employment levels. The following subsections describe more specifically the steps DOE took in developing the information on which it based the MIA.

13.2.1 Phase I: Industry Profile

In Phase I of the MIA, DOE prepared a profile of the conventional cooking products and microwave oven industries that built upon the market and technology assessment prepared for this rulemaking (see chapter 3 of this TSD). Before initiating the detailed impact studies, DOE collected qualitative and quantitative financial information and past and present market data. This included estimated market shares, corporate operating ratios, wages, employment, and production cost ratios for several home appliance manufacturers. The industry profile included a top-down cost analysis of cooking product manufacturers that DOE used to derive cost and preliminary financial inputs for the GRIMs (*e.g.*, revenues; material; labor; overhead; depreciation; selling, general and administrative expenses (SG&A); and research and development (R&D) expenses).

DOE also used public information to further calibrate its initial characterization of the conventional cooking products and microwave oven industries, including Securities and Exchange Commission (SEC) 10-K reports, Standard & Poor's (S&P) stock reports, Dun and Bradstreet company profiles, corporate annual reports, and U.S. Census Bureau's 2006 *Annual Survey of Manufacturers* (2006 ASM). In addition, DOE relied on information from its engineering analysis, life-cycle cost analysis, and analysis of markups to determine product prices to characterize these industries.

13.2.2 Phase II: Industry Cash-Flow Analysis and Interview Guide

In Phase II, DOE performed industry cash-flow analyses and prepared written guidelines for interviewing manufacturers. Phase II focused on the financial impacts of new standards on the conventional cooking product and microwave oven industries. New standards can affect manufacturers in these industries in three distinct ways: (1) require additional investment, (2) raise production costs, and (3) impact revenues through higher prices and possibly lower shipments. The analytical tool DOE uses for calculating the financial impacts of new energy conservation standards on manufacturers is the GRIM. DOE performed a cash flow analysis using a separate GRIM for the conventional cooking products and microwave oven industries to quantify these impacts.

13.2.2.1 Industry Cash-Flow Analysis

The GRIM uses several factors to determine a series of annual cash flows for the year standards become effective and several years after implementation. These factors include annual expected revenues; costs of sales; SG&A expenses; taxes; and capital expenditures related to new standards. Inputs to the GRIM include manufacturing costs, shipments forecasts, and prices developed in other analyses. DOE derived the manufacturing costs from the engineering analysis and information provided by the industry, and estimated typical manufacturer markups from public financial reports and interviews with manufacturers. Where applicable, DOE used figures from its 1996 *Technical Support Document for Residential Cooking Products* (1996 TSD) revised by current production volumes and the Producer Price Index (PPI). DOE developed alternative markup scenarios for each GRIM based on discussions with manufacturers during the rulemaking. DOE's shipments analysis, presented in chapter 10 of this TSD, provided the basis for the shipments projection under each TSL in each GRIM. The financial parameters were developed using publicly available data of manufacturers of products covered by this rulemaking. These parameters were revised with information submitted confidentially during manufacturer interviews. The results of the GRIM are compared against base-case projections equivalent to baseline efficiency levels defined in the 1996 TSD for all cooking product categories. The financial impact of new energy conservation standards is the difference between the baseline and the standards-impacted sets of discounted annual cash flows.

13.2.2.2 Interview Guide

During Phase III of the MIA, DOE conducted interviews with manufacturers that cover all or some cooking product categories to gather information on the effects of new energy conservation standards on revenues and finances, direct employment, capital assets, and on industry competitiveness. Prior to the interviews, DOE distributed a standard interview guide for each major product category that provided a starting point to identify relevant issues and help identify the impacts of new energy conservation standards on individual manufacturers or sub-groups of manufacturers. The interview guide covered current organizational characteristics, industry infrastructure, manufacturer cash-flow analysis, a competitive impacts assessment, an employment impacts assessment, and a manufacturing capacity impacts assessment. The interview guides used to conduct the manufacturer interviews are found in appendix 13-A of this TSD.

13.2.3 Phase III: Sub-Group Analysis

During the course of the MIA, DOE interviewed manufacturers representing 25 to 82 percent of unit shipments of cooking products, depending on the specific cooking product category. Many of these same companies also participated in interviews for the engineering analysis. However, the MIA interviews broadened the discussion from primarily technology-related issues to include business-related topics. One objective was to obtain feedback from industry on the approaches used in the GRIM and to isolate key issues and concerns. During interviews, DOE defined one appliance manufacturer sub-group that could be impacted by the energy conservation standards. DOE identified two small businesses that manufacture only residential cooking products. The following sections summarize the methodology and findings of this assessment.

13.2.3.1 Manufacturer Interviews

The information gathered in Phase I and the cash-flow analysis performed in Phase II are supplemented with information gathered during interviews with manufacturers during Phase III. The interview process has a key role in the manufacturer impact analyses, since it provides an opportunity for interested parties to express their views privately on important issues, allowing confidential or sensitive information to be considered in the rulemaking process.

DOE prepared two different interview guides – one for manufacturers of conventional cooking products (cooktops, ovens, and ranges) and one for microwave oven manufacturers. DOE used these interviews to tailor each GRIM to incorporate unique financial characteristics for each group of products. Within each of these manufacturer groups, DOE contacted companies from its database of manufacturers, which provided a representation of each industry. Small and large companies, subsidiaries and independent firms, and public and private corporations were interviewed. Interviews were scheduled well in advance in order to provide every opportunity for key individuals to be available for comment. Although a written response to the questionnaire was acceptable, DOE preferred an interactive interview process because it helped clarify responses and provide the opportunity to identify additional issues.

DOE conducted detailed interviews with all manufacturers that agreed to participate to gain insight into the range of potential impacts and how this range varies with each TSL. The resulting qualitative and quantitative information are valuable inputs for the GRIMs that were developed for each of the product categories.

13.2.3.2 Revised Industry Cash-Flow Analysis

In Phase II of the MIA, DOE provided manufacturers with preliminary GRIM input financial figures for review and evaluation. During the interviews, DOE requested comment and suggestions regarding the values selected for the parameters. Upon completion of the interviews, DOE revised its industry cash flow models based on the feedback provided through the interviews. More information on how DOE calculated the parameters for the industry GRIMs is found in section 13.4.3 of this chapter.

13.2.3.3 Manufacturer Sub-Group Analysis

Using average cost assumptions to develop an industry cash flow estimate is not adequate for assessing differential impacts among sub-groups of manufacturers. Small, category-focused manufacturers or manufacturers exhibiting a cost structure that differs significantly from the industry average could be more negatively affected. Ideally, DOE would consider the impact on every manufacturer individually; however, it typically uses the results of the industry characterization to group manufacturers exhibiting similar characteristics. During the interview process, DOE discussed the potential sub-groups and sub-group members that have been identified for the analysis. DOE looked to the manufacturers and other interested parties to suggest sub-groups or characteristics that are the most appropriate for the analysis.

13.2.3.4 Small-Business Manufacturer Subgroup

DOE used the small business size standards published on March 11, 2008, as amended, by the Small Business Administration (SBA) to determine whether any small entities would be required to comply with the rule. 61 FR 3286 and codified at 13 CFR Part 121. The size standards are listed by North American Industry Classification System (NAICS) code and industry description. DOE used the SBA limits and NAICS classifications to determine if any small businesses would be affected by this rulemaking. For the product categories under review, the SBA bases its small business definition on the total number of employees for a business, its subsidiaries, and its parent companies. Whenever an aggregated business entity has less than the listed number of employees, it is considered a small business. Household cooking appliance manufacturing, which covers both conventional cooking products and microwave oven manufacturing, is classified under NAICS code 335221. An entity classified under NAICS 335221 is considered a small business if the total employment is less than 750.

DOE surveyed the Association of Home Appliance Manufacturers (AHAM) members directory to identify manufacturers of cooking products. DOE also asked interested parties and AHAM representatives within the cooking product industries if they were aware of any other small business manufacturers. DOE then consulted publicly available data, purchased company reports from vendors such as Dun and Bradstreet, and contacted manufacturers, where needed, to determine if they meet the SBA's definition of a small business manufacturing facility and have their manufacturing facilities located within the United States.

Based on this analysis, DOE estimates that there are two small businesses that manufacture conventional cooking products. DOE is not aware of any small businesses in the microwave oven product category. Like all other manufacturers that were identified as supplying the U.S. market, DOE contacted both small businesses making conventional cooking appliances to solicit an interview. Both small businesses replied with varying amounts of information that consisted of written responses and/or interviews. Besides posing the standard MIA interview questions, DOE solicited any data that would detail differential impacts on these companies that may result from a standard.

DOE found some differences in the R&D emphasis and marketing strategies between small business manufacturers and large manufacturers. These two manufacturers sell residential equipment that is differentiated from larger manufacturers' offerings due to size or use (*i.e.*, have a standing pilot). In addition to the elimination of standing pilots, any rule affecting products manufactured by these small businesses will impact them disproportionately because of their size and their focus on cooking appliances. However, due to the low number of competitors that agreed to be interviewed, DOE was not able to characterize this industry segment with a separate cash-flow analysis due to concerns about maintaining confidentiality and uncertainty regarding the quantitative impact on revenues of a standing pilot ban. Consequently, DOE used the same GRIM, which models each product class separately, to represent the small businesses affected by standards and performed a qualitative evaluation of the differential impacts on these manufacturers. Impacts on these small businesses are found in section 13.7.

13.2.3.5 Manufacturing Capacity Impact

One of the significant outcomes of new energy conservation standards could be the consequential obsolescence of existing manufacturing assets, including tooling and investment. The manufacturer interview guide has a series of questions to help identify impacts on manufacturing capacity, specifically capacity utilization and plant location decisions in the United States and North America with and without a standard; the ability of manufacturers to upgrade or remodel existing facilities to accommodate the new requirements due to new energy conservation standards; the nature and value of stranded assets, if any; and estimates for any one-time restructuring and other charges, where applicable.

13.2.3.6 Employment Impact

The impact of new energy conservation standards on employment is an important consideration in the rulemaking process. To assess how domestic employment patterns might be affected, the interviews explored current employment trends in the conventional cooking products and microwave oven industries. In addition, the interviews solicited manufacturer views on changes in employment patterns that may result from more stringent standard levels. The employment impacts section of the interview guide focused on current employment levels associated with manufacturers at each of their production facilities, expected future employment levels with and without new energy conservation standards, and differences in workforce skills and issues related to the retraining of employees.

13.2.3.7 Cumulative Regulatory Burden

DOE recognizes and seeks to mitigate the overlapping effects on manufacturers due to new energy conservation standards and other regulatory actions affecting the same products. DOE analyzed and considered the impact on manufacturers of multiple, product-specific regulatory actions. Based on its own research and discussions with manufacturers, DOE identified several regulations relevant to cooking product manufacturers including: Federal energy conservation standards for other products manufactured by cooking product manufacturers, and other environmental regulations.

13.3 MANUFACTURER IMPACT ANALYSIS KEY ISSUES

Each MIA starts by asking: “What are the key issues for your company regarding the energy conservation standard rulemaking?” This open question initiates dialogue with the manufacturers, enabling them to identify the issues that they feel DOE should explore and discuss further during the interview. The following section describes key issues mentioned for all product categories under review. Manufacturers indicated that, for the most part, the risks associated with these issues increase with more stringent TSLs.

13.3.1 Conventional Cooking Products

13.3.1.1 Lack of Cost-Effective Design Options for Energy Conservation Standards

All manufacturers believe that available products are already highly efficient and that additional energy savings are not cost-effective. For example, according to multiple manufacturers, any changes to the cavity of ovens and ranges require extensive engineering, significant capital investments, and result in a substantial price increase for consumers. Switching current parts, such as heating elements, insulation, or door seals, may not be capital intensive from a manufacturing point of view, but would require extensive engineering resources (*e.g.*, redesigning, testing, and certification), which carry a high cost. Absent standards, efficiency improvements which initially appear first in high-end products tend to naturally trickle down the product line over time. Finally, all manufacturers stated that increases in prices are not easily accepted by consumers in the market place. Due to the high initial costs and long payback periods, consumers will experience price increases by any cooking efficiency standard set by DOE.

13.3.1.2 Standing Pilot Ignition Systems

Manufacturers of conventional cooking products with standing pilot lights believe there are several issues regarding the elimination of standing pilot lights including; (1) the consumer utility of standing pilot ignition systems; (2) refurbishment of existing equipment with standing pilot ignition; and (3) the effects of ignition system switching.

- Consumer utility of standing pilot ignition systems – According to manufacturers, cooktops, ovens, and ranges with standing pilot ignition systems provide a unique performance characteristic and meet unique consumer needs since they can operate without the use of electricity. The unique consumer utility of standing pilot ignition includes: (1) providing safe ignition where electrical supply is unavailable (such as lodges and hunting cabins), and (2) providing safe ignition where religious and cultural practices prohibit the use of electronic ignition systems. Multiple manufacturers stated that remote areas which do not have electricity or have religious objections to line power in the home will be impacted disproportionately because there currently are no alternatives for such consumers.
- Refurbishment of existing equipment with standing pilot ignitions – One manufacturer stated that if standing pilot ignition systems are eliminated on new equipment, that the refurbishment of used units would increase. Without alternatives, customers would be forced to extend the lifetime of these products, which would correspond to decreased revenues for manufacturers. Multiple manufacturers also stated that aftermarket alternatives not intended for indoor cooking appliances could potentially be installed and would result in safety issues: Unless the ignition system is installed by the manufacturer of the cooking product, it may not perform to safety standards and may cause potential fire hazards because of incorrect installation and operation.
- Effects of ignition system switching – Multiple manufacturers mentioned that the power cords on gas cooking appliances are intentionally kept short to ensure that they are only

used with outlets specifically intended for these appliances. These manufacturers expressed a concern that consumers may balk at the cost of retrofitting line power behind a range, oven, or cooktop and would resort to using extension cords instead, a potential safety hazard. According to one manufacturer, the cost of installing an outlet for electronic ignition systems is costly and negates the savings from less fuel use.

13.3.1.3 Profitability

All manufacturers stated that energy conservation standards have the potential to greatly harm their profitability. Several manufacturers stated it is impossible to pass along cost increases to customers because of the competitive nature of the industry: Any cost increase due to standards set by DOE would thus automatically lower profit margins. Several manufacturers also stated that cooking standards have the potential to lower the market share of domestic manufacturers. Multiple manufacturers stated that any standard that creates the need for a complete redesign eliminates the competitive advantage of domestic firms.

13.3.2 Microwave Ovens

13.3.2.1 Standby Power

While microwave oven standby power was not considered for this final rule, manufacturers of microwave ovens are concerned that possible standby power additions to the microwave oven test procedure could reduce consumer utility. For example, one manufacturer stated that it is not aware of cooking sensors that do not require standby power and thus a low standby power standard could lead to the elimination of cooking sensors from its products. However, multiple manufacturers stated that they already use or are in the process of adopting no-standby cooking sensors. All manufacturers stated that low standby power levels would impact display and controls choices which would also affect consumer utility. Manufacturers stated that standards have the potential to eliminate remaining U.S. production due to already tight margins.

13.3.2.2 Profitability

As with conventional cooking products, manufacturers of microwave ovens stated that high energy factor standards have the potential to hurt profitability. Manufacturers typically earn a premium on higher-end models while low-end models are extremely commoditized. The premium on high-end equipment would be squeezed if standards eliminated product differentiators or energy factor standards forced high-end features to lower end models.

13.4 GRIM INPUTS AND ASSUMPTIONS

The GRIM serves as the main tool for assessing the impact on industry due new energy conservation standards. DOE relies on several sources to obtain inputs for the GRIM. Data and assumptions from these sources are then feed into an accounting model that details the cash flow on a baseline basis, as well as calculates the impacts on manufacturers due to new energy conservation standards. Two GRIM models were developed, one for conventional cooking products and one for microwave ovens.

13.4.1 Overview of the GRIM

The basic structure of the GRIM, illustrated in Figure 13.4.1, is an annual cash flow analysis that uses manufacturer prices, manufacturing costs, shipments, and industry financial information as inputs, and accepts a set of regulatory conditions such as changes in costs, investments, and associated margins. The GRIM spreadsheet uses a number of inputs to arrive at a series of annual cash flows, beginning with the base year of the analysis, 2007, and continuing explicitly through 2042. The model calculates the INPV by summing the stream of annual discounted cash flows during this period.¹

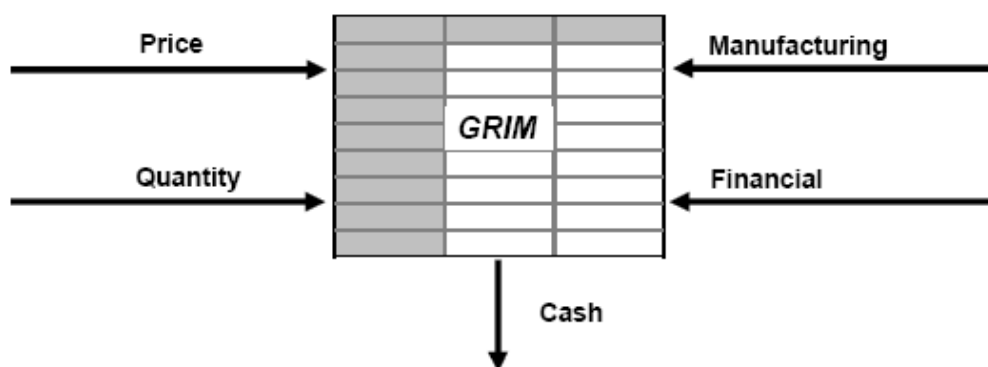


Figure 13.4.1 Using the GRIM to Calculate Cash Flow

The GRIM projects cash flows using standard accounting principles and compares changes in INPV between the base case scenario and the standard case scenario, evaluating changes induced by the new energy conservation standards. The difference in INPV between the base case and the standard case(s) represents the estimated financial impact of the new energy conservation standard on manufacturers. Appendix 13-B provides more technical details and user information for the GRIM.

13.4.2 Sources GRIM Inputs

The GRIM uses several different sources for data inputs in determining the cash flows for the industry, including corporate annual reports, company profiles, Census data, credit ratings, the shipments model, the engineering analysis, and the manufacturer interviews.

13.4.2.1 Corporate Annual Reports

Corporate annual reports to the Securities and Exchange Commission (SEC 10-Ks) provided many of the financial inputs to the GRIM.² These reports exist for publicly held companies and are freely available to the general public. DOE developed average financial inputs to the GRIM by examining the annual SEC 10-K reports filed by publicly-traded manufacturers primarily engaged in appliance manufacturing and whose combined product range includes cooktops, ovens, ranges, and microwaves. Because these companies are typically diversified, producing a range of different appliances, an industry average was assumed by DOE to be representative for the manufacture of each type of appliance. Since these companies do

not provide detailed information about their individual product lines, DOE used the financial information for the entire companies to represent the financial parameters in both GRIMs. In determining financial parameters for the industries, DOE weighted corporate financial information contained in the SEC 10-Ks by each company's estimated market share to arrive at industry-weighted averages. DOE used corporate annual reports to derive the following GRIM inputs:

- Tax rate,
- Working capital,
- Sales, general, and administration expenses (SG&A),
- Research and development (R&D) expenses,
- Depreciation,
- Capital expenditures, and
- Net property, plant, and equipment (PPE).

DOE also used information from company SEC 10-K reports to calibrate the GRIM's operating profit margin against the industry weighted average.

13.4.2.2 Standard and Poor Credit Ratings

Standard and Poor (S&P) provides independent credit ratings, research, and financial information. S&P reports are available for a nominal fee. DOE relied on S&P reports to determine the industry's average cost of debt for the cost of capital calculation.

13.4.2.3 Dun and Bradstreet Reports

Dun and Bradstreet (D&B) provides independent research regarding company cash flows, revenues, employees, and credit-worthiness. Besides conducting manufacturer interviews, DOE used D&B reports to profile several manufacturers which had the potential to be small businesses.

13.4.2.4 Shipment Model

The GRIM used shipment projections derived from DOE's shipments model in the national impact analysis. The model relied on historical shipments data for cooking products. Chapter 10 of the TSD describes the methodology and analytical model DOE used to forecast shipments.

13.4.2.5 Engineering Analysis

During the engineering analysis, DOE used data submitted from AHAM, information from the 1996 TSD, and manufacturer interviews to develop manufacturing cost estimates for conventional cooking products and microwave ovens. The analysis provided labor, materials, and overhead production costs which are representative of the conventional cooking products

and microwave oven industries. For cooking products, the costs determined in the 1996 TSD were adjusted to 2006 prices based on the PPI.^a

13.4.2.6 Manufacturer Interviews

During the course of the MIA, DOE conducted interviews with manufacturers representing approximately 75 percent of the conventional cooking appliance industry and 35 percent of microwave manufacturers. During these discussions, DOE obtained information, which it used to determine and verify GRIM input assumptions for each industry. Key topics discussed during the interviews and reflected in the GRIM include:

- Capital conversion costs (one-time investments in property, plant, and equipment);
- Product conversion costs (one-time investments in research, product development, testing, and marketing);
- The portion of the capital conversion costs that companies use to replace stranded assets;
- Product cost structure: The portion of the manufacturer production costs related to materials, labor, overhead, and depreciation costs;
- Projected total shipment and shipment distribution mix; and
- Production costs estimated in the engineering analysis.

13.4.3 Financial Parameters

Table 13.4.1 provides financial parameters for three public companies engaged in manufacturing and selling cooking products. The values listed are averages over an eight-year period (1999-2006).

Table 13.4.1 GRIM Financial Parameters Based on 1999-2006 Weighted Company Financial Data

Parameter	Industry-Weighted Average	Manufacturer		
		A	B	C
Tax Rate (% of Taxable Income)	33.9	6.6	34.1	34.5
Working Capital (% of Revenue)	2.9	9.6	5.6	2.0
SG&A (% of Revenue)	13.0	12.7	12.3	13.2
R&D (% of Revenues)	2.3	2.3	2.0	2.4
Depreciation (% of Revenues)	3.4	3.9	3.4	3.3
Capital Expenditures (% of Revenues)	3.5	1.9	3.4	3.6
Net Property, Plant, and Equipment (% of Revenues)	19.9	17.3	21.6	19.4

These companies constitute a significant portion of the cooking product industries. For other companies in the industry, public data is not available and was not used to calculate the

^a For more information on the PPI, please see the Bureau of Labor Statistics web-site at: <http://www.bls.gov>

parameters. The values used in the GRIMs, therefore, represent the industry's weighted-average estimates using financial data from three publicly traded manufacturers. During manufacturer interviews, manufacturers of cooking products were asked to review the parameters listed in Table 13.4.1 and comment on how the parameters related to their specific industry. Where applicable, the parameters were then adjusted for the GRIM for each industry.

13.4.4 Corporate Discount Rate

DOE used the weighted-average cost of capital (WACC) for the industry as the discount rate to calculate the INPV. A company's assets are financed by a combination of debt and equity. The WACC is the total cost of debt and equity weighted by their respective proportions in the capital structure of the industry.¹ DOE estimated the WACC for the cooking product industries based on several representative companies, using the following formula:

$$WACC = \text{After-Tax Cost of Debt} \times (\text{Debt Ratio}) + \text{Cost of Equity} \times (\text{Equity Ratio})$$

The cost of equity is the rate of return that equity investors (including, potentially, the company) expect to earn on a company's stock. These expectations are reflected in the market price of the company's stock. The capital asset pricing model (CAPM) provides one widely used means to estimate the cost of equity. According to the CAPM, the cost of equity (expected return) is:

$$\text{Cost of Equity} = \text{Riskless Rate of Return} + \beta \times \text{Risk Premium}$$

where:

Riskless rate of return is the rate of return on a "safe" benchmark investment, typically considered the short-term Treasury Bill (T-Bill) yield.

Risk premium is the difference between the expected return on stocks and the riskless rate.

Beta (β) is the correlation between the movement in the price of the stock and that of the broader market. In this case, Beta equals one if the stock is perfectly correlated with the S&P 500 market index. A Beta lower than one means the stock is less volatile than the market index.

DOE determined that the industry average cost of equity for the cooking product industries is 17.9 percent as calculated in Table 13.4.2.

Table 13.4.2 Cost of Equity Calculation

Parameter	Industry-Weighted Average (%)	Manufacturer		
		A	B	C
(1) Average Beta (2002 – 2006 year)	1.31	1.0*	1.77	1.17
(2) Yield on 10 Year T-Bill (1990-2006)	5.9	-	-	-
(3) Market Risk Premium (1926-1999)	9.2	-	-	-
Cost of Equity (2)+[(1)*(3)]	17.9	-	-	-
Equity/Total Capital	37.2	23.7	-49.8	64.6

* Estimated Beta

Bond ratings are a tool to measure default risk and arrive at a cost of debt. Each bond rating is associated with a particular spread. One way of estimating a company's cost of debt is to treat it as a spread (usually expressed in basis points) over the risk-free rate. DOE used this method to calculate the cost of debt for all three manufacturers. S&P had bond ratings for all three manufacturers, so DOE used these ratings to estimate the manufacturers' cost of debt by adding the relevant spread to the risk-free rate.

In practice, investors use a variety of different maturity Treasury bonds to estimate the risk-free rate. DOE used a long-term Treasury bond return (10-year bond return) because it captures long-term inflation expectations and is less volatile than short-term rates. The risk free rate is estimated to be approximately six percent, which is the average 10-year Treasury bond return over the period of 1990 to 2006.

For the cost of debt, S&P's Credit Services provided the average spread of corporate bonds for the three public manufacturers over the period 2002-2006. To this, DOE added the industry-weighted average spread to the average T-Bill yield over the same period. Since proceeds from debt issuance are tax deductible, DOE adjusted the gross cost of debt by the industry average tax rate to determine the net cost of debt for the industry. Table 13.4.3 presents the derivation of the cost of debt. Also shown is the capital structure of the industry, *i.e.* the debt ratio (debt/total capital).

Table 13.4.3 Cost of Debt Calculation

Parameter	Industry-Weighted Average (%)	Manufacturer		
		A	B	C
S&P Bond Rating	--	B-	BBB	BBB
(1) Yield on 10 year T-Bill (1990-2002)	5.9	-	-	-
(2) Gross Cost of Debt	8.2	13.9	8.1	8.1
(3) Tax Rate	34	6.6	34.1	34.5
Net Cost of Debt (2)x((1)-(3))	5.4	-	-	-
Debt/Total Capital	62.8	76.3	149.8	35.4

DOE estimated the conventional cooking products and microwave oven industries' WACC to be approximately 10.1 percent. Subtracting an inflation rate of 2.9 percent between 1990 and 2006, the inflation adjusted WACC, and the corporate discount rate used in the GRIM, is 7.2 percent.

13.4.5 Trial Standard Levels

DOE developed TSLs for conventional cooking products and microwave ovens. As previously discussed, the affects of TSLs on cooktops, ovens, and ranges are examined in one GRIM and the affects of TSLs for microwave ovens are examined in another. Chapter 9 of the TSD describes the methodology DOE used to determine each TSL for each of the separate GRIMs. The efficiency levels used in the GRIMs are presented in Table 13.4.4 through Table 13.4.5

Table 13.4.4 Cooktops and Ovens Baseline Efficiency Levels and TSLs

Product Class	Efficiency Metric	Baseline	TSL 1	TSL 2	TSL 3	TSL 4
Electric Coil Cooktops	EF	0.7370	0.7370	0.7690	0.7690	0.7690
Electric Smooth Cooktops	EF	0.7420	0.7420	0.7420	0.7420	0.7530
Gas Cooktops	EF	0.1560	0.3990	0.3990	0.3990	0.4200
Electric Standard Ovens	EF	0.1066	0.1066	0.1163	0.1163	0.1209
Electric Self-Clean Oven	EF	0.1099	0.1099	0.1099	0.1099	0.1123
Gas Standard Oven	EF	0.0298	0.0583	0.0583	0.0583	0.0600
Gas Self-Clean Oven	EF	0.0540	0.0540	0.0540	0.0625	0.0632

Table 13.4.5 Microwave Ovens Baseline Energy Factor Efficiency Levels and TSLs

Product Class	Efficiency Metric	Baseline	TSL 1	TSL 2	TSL 3	TSL 4
Microwave Ovens	EF	0.557	0.586	.0588	0.597	0.602

13.4.6 NES-Shipments Forecast

The GRIM estimates manufacturer revenues based on total-unit-shipment forecasts and the distribution of these values by efficiency level. Changes in the efficiency mix at each standard level are a key driver of manufacturer finances. For this analysis, the GRIM used the national energy savings (NES) shipments forecasts for cooktops, ovens, ranges, and microwave ovens from 2007 to 2042. Further explanation of approaches and calculations of total shipments can be found in the shipment analysis section of this TSD (chapter 10). Total shipments forecasted in the shipment analysis for all efficiency levels in 2012 are shown in Table 13.4.6 and are further detailed below.

Table 13.4.6 Total NES-Shipments Forecast in 2012

Product Class	Total Shipments*
Electric Coil Cooktops	2,335,076
Electric Smooth Cooktops	2,756,443
Gas Cooktops	3,660,950
Electric Standard Ovens	1,346,197
Electric Self-Clean Ovens	4,167,780
Gas Standard Ovens	1,420,675
Gas Self-Clean Ovens	1,749,377
Microwave Ovens	15,999,339

* Estimates rounded to the nearest hundred

13.4.6.1 Base Case Shipments Forecast

As part of the shipment analysis, DOE estimated the shipment distribution by efficiency level for cooktops and ovens and microwave ovens. Table 13.4.7 through Table 13.4.8 show the base case distributions of shipments by TSL estimated in the NES for various product classes for 2012.

Table 13.4.7 Base Case Distribution of Efficiencies for Cooktops and Ovens Estimated in 2012 in the NES

Product Class	Efficiency Metric	Base Case Distribution of Shipments by Efficiencies				
		Baseline	TSL 1	TSL 2	TSL 3	TSL 4
Electric Coil Cooktops	EF	100%	0%	0%	0%	0%
Electric Smooth Cooktops	EF	100%	0%	0%	0%	0%
Gas Cooktops	EF	6.8%	92.3%	0%	0%	0%
Electric Standard Ovens	EF	100%	0%	0%	0%	0%
Electric Self-Clean Oven	EF	100%	0%	0%	0%	0%
Gas Standard Oven	EF	17.6%	82.4%	0%	0%	0%
Gas Self-Clean Oven	EF	100%	0%	0%	0%	0%

Table 13.4.8 Base Case Energy Factor Distribution of Efficiencies for Microwave Ovens in 2012 Estimated in the NES

Shipments Efficiency Level (EF)	Baseline 0.557	TSL 1 0.586	TSL 2 0.588	TSL 3 0.597	TSL 4 0.602
Baseline 0.557	100%	0%	0%	0%	0%

13.4.6.2 Standards Case Shipments Forecast

To examine the effects of new energy conservation standards on shipments, which affect the INPV, DOE used the base case shipments described in the previous section. For the standards case, DOE assumed shipments at lower efficiencies were most likely to roll up into higher efficiency levels in response to an increase in energy conservation standards. This pessimistic scenario assumes that demand for high efficiency equipment is a function of its price

without regards for the standard level. Table 13.4.9 through Table 13.4.16 show the distributions of efficiencies for the various equipment classes in 2012 under the roll-up scenario.

Table 13.4.9 Distribution of Electric Coil Cooktop Shipments in the Standards Case – Rollup Scenario

TSL (EF)	Baseline 0.7370	TSL 1, 2, 3, 4 0.7690
Baseline 0.7370	100%	0%
TSL 1, 2, 3, 4 0.7690		100%

Table 13.4.10 Distribution of Electric Smooth Cooktop Shipments in the Standards Case in 2012 – Rollup Scenario

TSL (EF)	Baseline, TSL 1, 2, 3 0.7420	TSL 4 0.7530
Baseline, TSL 1, 2, 3 0.7420	100%	0%
TSL 4 0.7530		100%

Table 13.4.11 Distribution of Gas Cooktop Shipments in the Standards Case in 2012 – Rollup Scenario

TSL (EF)	Baseline 0.1560	TSL 1, 2, 3 0.3990	TSL 4 0.4200
Baseline 0.1560	6.8%	93.2%	0%
TSL 1, 2, 3 0.3990		100%	0%
TSL 4 0.4200			100%

Table 13.4.12 Distribution of Electric Standard Oven Shipments in the Standards Case in 2012 – Rollup Scenario

TSL (EF)	Baseline, TSL 1 0.1066	TSL 2, 3 0.1163	TSL 4 0.1209
Baseline, TSL 1 0.1066	100%	0%	0%
TSL 2, 3 0.1163		100%	0%
TSL 4 0.1209			100%

Table 13.4.13 Distribution of Electric Self-Clean Oven Shipments in the Standards Case in 2012 – Rollup Scenario

TSL (EF)	Baseline, TSL 1, 2, 3 0.1099	TSL 4 0.1123
Baseline, TSL 1, 2, 3 0.1099	100%	0%
TSL 4 0.1123		100%

Table 13.4.14 Distribution of Gas Standard Oven Shipments in the Standards Case in 2012 – Rollup Scenario

TSL (EF)	Baseline 0.0298	TSL 1, 2, 3 0.0583	TSL 4 0.0600
Baseline 0.0298	17.6%	82.4%	0%
TSL 1, 2, 3 0.0583		100%	0%
TSL 4 0.0600			100%

Table 13.4.15 Distribution of Gas Self-Clean Oven Shipments in the Standards Case in 2012 – Rollup Scenario

TSL (EF)	Baseline, TSL 1, 2 0.0540	TSL 3 0.0625	TSL 4 0.0632
Baseline, TSL 1, 2 0.0540	100%	0%	0%
TSL 3 0.0625		100%	0%
TSL 4 0.0632			100%

Table 13.4.16 Distribution of Energy Factor Microwave Oven Shipments in the Standards Case in 2012 – Rollup Scenario

TSL (EF)	Baseline 0.557	TSL 1 0.586	TSL 2 0.588	TSL 3 0.597	TSL 4 0.602
Baseline 0.557	100%	0%	0%	0%	0%
TSL 1 0.586		100%	0%	0%	0%
TSL 2 0.588			100%	0%	0%
TSL 3 0.597				100%	0%
TSL 4 0.602					100%

13.4.6.3 Price Elasticity of Demand Shipments Scenario

In the microwave oven GRIM, DOE modeled a shipment scenario that considers the impacts of changes in relative prices on consumer demand for each product. As described in the purchase price, operating cost, and household income impacts found in the shipments model in chapter 10, this shipment scenario estimates how the combined effects of increases in purchase price and decreases in operating costs due to new energy conservation standards affect shipments. DOE calculated the relative price elasticity of demand over time to determine how shipments would likely change after a standard sets a higher initial purchase price and lower operating costs. For the microwave oven GRIM shipments under the “price elasticity scenario,” the effects from the increase in product purchase prices offset the effects from decreased operating costs, resulting in a net decrease in shipments. See chapter 10 for more details on the shipment scenarios.

13.4.6.4 Economic Growth Shipments Scenario

In all three GRIMs, DOE modeled three shipment scenarios that consider the impacts of changes in the overall U.S. economy. These shipment scenarios are based on the Energy Information Administration’s (EIA) 2008 *Annual Energy Outlook Report* (AEO2008) for the period 1990–2030.³ AEO2008 provides three scenarios: the Reference case, the High Economic Growth case, and the Low Economic Growth case. DOE only presents results using the Reference case shipments, not the economic growth shipment scenarios. However, this option is left as an option for the user to select in both GRIMs. It is also possible for the user to combine the price elasticity scenario with an economic scenario in the microwave oven GRIM. See chapter 10 for more details on the economic growth shipment scenarios.

13.4.7 Production Costs

Changes in production costs impact revenues and gross profits. As shown in the engineering analysis (chapter 5), products that are more efficient usually cost more to produce than baseline products. For the MIA, DOE used the manufacturing production costs (MPCs) derived in the engineering analysis, with appropriate production volume estimates. For instance, more efficient products sold under existing energy conservation standards are manufactured at lower production volumes than standard efficiency products. Enacting more stringent energy conservation standards will increase production volumes of more efficient units.

As described in chapter 5, the costs of conventional cooking products and microwave ovens were calculated using data found in the 1996 TSD adjusted by production volume and the producer price index. The GRIM included the proportion of costs devoted to labor, materials, overhead, and depreciation that make up the full cost of production or MPCs. DOE estimated the proportion of costs associated with each cost category by using information provided by AHAM⁴ and U.S. Census Bureau’s Current Industry Reports (CIR)⁵ and 2006 ASM (see section 13.8.1.1 for derivation of the industry cost structures). Table 13.4.17 through Table 13.4.24 provide the MPC results used in the GRIM for cooktops and ovens, and microwave ovens.

Table 13.4.17 Base Case Production Costs (2006\$) used in the GRIM for Electric Coil Cooktops

TSL (EF)	Labor	Material	Overhead	Depreciation	MPC
Baseline, TSL 1 (0.7370)	\$7.21	\$68.70	\$2.23	\$3.50	\$81.63
TSL 2, 3, 4 (0.7690)	\$7.41	\$70.62	\$2.29	\$3.59	\$83.91

Table 13.4.18 Base Case Production Costs (2006\$) used in the GRIM for Electric Smooth Cooktops

TSL (EF)	Labor	Material	Overhead	Depreciation	MPC
Baseline, TSL 1, 2, 3 (0.7420)	\$7.87	\$75.02	\$2.43	\$3.82	\$89.14
TSL 4 (0.7530)	\$15.74	\$149.99	\$4.86	\$7.64	\$178.23

Table 13.4.19 Base Case Production Costs (2006\$) used in the GRIM for Gas Cooktops

TSL (EF)	Labor	Material	Overhead	Depreciation	MPC
Baseline (0.1560)	\$7.87	\$74.98	\$2.43	\$3.82	\$89.09
TSL 1, 2, 3 (0.3390)	\$8.93	\$85.13	\$2.76	\$4.33	\$101.15
TSL 4 (0.4200)	\$10.70	\$101.96	\$3.30	\$5.19	\$121.15

Table 13.4.20 Base Case Production Costs (2006\$) used in the GRIM for Electric Standard Ovens

TSL (EF)	Labor	Material	Overhead	Depreciation	MPC
Baseline, TSL 1 (0.1066)	\$12.91	\$123.01	\$3.99	\$6.26	\$146.17
TSL 2, 3 (0.1163)	\$13.34	\$127.09	\$4.12	\$6.47	\$151.01
TSL 4 (0.1209)	\$17.47	\$166.51	\$5.40	\$8.48	\$197.86

Table 13.4.21 Base Case Production Costs (2006\$) used in the GRIM for Electric Self-Clean Ovens

TSL (EF)	Labor	Material	Overhead	Depreciation	MPC
Baseline, TSL 1, 2, 3, (0.1099)	\$16.35	\$155.82	\$5.05	\$7.93	\$185.15
TSL 4 (0.1123)	\$20.23	\$192.83	\$6.25	\$9.82	\$229.13

Table 13.4.22 Base Case Production Costs (2006\$) used in the GRIM for Gas Standard Ovens

TSL (EF)	Labor	Material	Overhead	Depreciation	MPC
Baseline (.0298)	\$13.67	\$130.28	\$4.22	\$6.63	\$154.80
TSL 1, 2, 3 (.0583)	\$14.99	\$142.90	\$4.63	\$7.27	\$169.80
TSL 4 (.0600)	\$17.57	\$167.40	\$5.43	\$8.52	\$198.91

Table 13.4.23 Base Case Production Costs (2006\$) used in the GRIM for Gas Self-Clean Ovens

TSL (EF)	Labor	Material	Overhead	Depreciation	MPC
Baseline, TSL 1, 2 (0.0540)	\$19.45	\$185.37	\$6.01	\$9.44	\$220.26
TSL 3 (0.0625)	\$20.42	\$194.63	\$6.31	\$9.91	\$231.27
TSL 4 (0.0632)	\$20.92	\$199.34	\$6.46	\$10.15	\$236.86

Table 13.4.24 Base Case Energy Factor Production Costs (2006\$) used in the GRIM for Microwave Ovens

TSL (EF)	Labor	Material	Overhead	Depreciation	MPC
Baseline (0.557)	\$10.62	\$101.18	\$3.28	\$5.15	\$120.23
TSL 1 (0.586)	\$11.38	\$108.49	\$3.52	\$5.52	\$128.91
TSL 2 (0.588)	\$12.20	\$116.29	\$3.77	\$5.92	\$138.18
TSL 3 (0.597)	\$13.49	\$128.56	\$4.17	\$6.54	\$152.76
TSL 4 (0.602)	\$15.13	\$144.20	\$4.67	\$7.34	\$171.34

13.4.8 Conversion Costs

New energy conservation standards typically cause manufacturers to incur one-time conversion costs to bring their production facilities and product designs into compliance with new regulations. For the purpose of the MIA, DOE classified these one-time conversion costs into two major groups: capital conversion costs and product conversion costs. Capital conversion costs are one-time investments in property, plant, and equipment to adapt or change existing production facilities so that new product designs can be fabricated and assembled under the new regulation. Product conversion costs are one-time investments in research, development, testing, and marketing focused on making product designs comply with new energy conservation standards. The following sections describe in greater detail the inputs DOE used in the GRIM.

13.4.8.1 Capital Conversion Costs

DOE evaluated the level of capital investment needed to comply with the new energy conservation standards at each TSL. For each TSL, DOE estimated the proportion of the products on the market will have to be redesigned to meet that TSL efficiency level. The higher the TSL, the greater the proportion of the products on the market that will require a redesign.

For conventional cooking products, DOE updated the capital conversion costs in the 1996 TSD with current manufacturing volumes and 2006 PPI figures. During interviews, manufacturers were asked to comment on the figures. When manufacturers responded with information about the necessary tooling costs at each TSL, the 1996 figures were revised based on the weighted market share of the companies responding. Where manufacturers did not comment, the updated figures from the 1996 TSD were used. Conversion capital at TSL1 through TSL3 is relatively small because the component switches for all product classes do not involve substantial changes to existing production equipment. However, at TSL 4 some product classes have changes that involve significant alterations to the cavity, which would require costly

tooling changes. Table 13.4.25 summarizes the breakdown of conversion capital expenditure by TSL for the conventional cooking products industry.

Table 13.4.25 Capital Conversion Costs for the Conventional Cooking Products Industry by TSL

TSL	Total Industry Conversion Capital Expenditure (2006\$ million) by Product Class							
	Electric Coil Cooktops	Electric Smooth Cooktops	Gas Cooktops	Electric Standard Oven	Electric Self-Clean Oven	Gas Standard Oven	Gas Self-Clean Oven	Industry Total
Baseline	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
TSL 1	\$0	\$0	\$2.2	\$0	\$0	\$1.8	\$0	\$4.0
TSL 2	\$0	\$0	\$2.2	\$0.8	\$0	\$1.8	\$0	\$4.7
TSL 3	\$0	\$0	\$2.2	\$0.8	\$0	\$1.8	\$5.8	\$10.6
TSL 4	\$0	\$73.1	\$3.3	\$125.9	\$53.9	\$55.1	\$16.9	\$328.2

For microwave ovens, DOE used a platform approach to estimate the capital conversion costs. DOE assumed that there were no capital conversion costs for TSL 1 through TSL 3. Component switches for these TSLs do not require changes to the microwave enclosure or cavity because these design options all have standard hole locations that will not be altered if more efficient components are used. However, TSL 4 would involve substantial product conversion capital because reflective surfaces would require stamping die changes. DOE estimated the tooling cost per platform for reflective surfaces and weighted the cost to account for the number of platforms offered by the industry. Table 13.4.26 summarizes the breakdown of conversion capital expenditure by TSL for the microwave oven industry.

Table 13.4.26 Energy Factor Conversion Capital Conversion Costs for the Microwave Oven Industry by TSL

TSL	Total Industry Conversion Capital Expenditure (2006\$ million)
Baseline	\$0
TSL 1	\$0
TSL 2	\$0
TSL 3	\$0
TSL 4	\$75.0

13.4.8.2 Product Conversion Expenses

DOE conducted interviews with manufacturers to better understand the many steps that manufacturers have to take before they can release new or improved products. The magnitude of the required investments varies by manufacturer and the TSL analyzed.

Multiple manufacturers estimate that the time and resources spent on research and development, testing, and certification of products would be significant depending on the design path chosen to achieve higher efficiency.

For conventional cooking products, DOE used the product conversion costs in the 1996 TSD updated by the 2006 PPI figures. DOE also used manufacturer responses, weighted market share, when manufacturers provided their own product conversion costs during interviews. At higher TSLs, manufacturers must perform reliability testing and certify a greater portion of their existing platforms, increasing the product conversion costs. Design costs also increase at higher TSLs because there is a greater chance that the component interacts with other parts of the platform, lengthening the redesign time and cost. Table 13.4.27 summarizes the breakdown of product conversion expenses by TSL for the conventional cooking products industry.

Table 13.4.27 Product Conversion Costs for the Conventional Cooking Products Industry by TSL

TSL	Total Industry Product Conversion Expenses (2006\$ million) by Product Class							
	Electric Coil Cooktops	Electric Smooth Cooktops	Gas Cooktops	Electric Standard Oven	Electric Self-Clean Oven	Gas Standard Oven	Gas Self-Clean Oven	Industry Total
Baseline	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
TSL 1	\$0	\$0	\$9.4	\$0	\$0	\$9.4	\$0	\$18.7
TSL 2	\$9.6	\$0	\$9.4	\$20.8	\$0	\$9.4	\$0	\$49.2
TSL 3	\$9.6	\$0	\$9.4	\$20.8	\$0	\$9.4	\$9.4	\$58.5
TSL 4	\$9.6	\$12.2	\$20.8	\$48.9	\$18.7	\$58.3	\$42.1	\$210.6

For microwave ovens, DOE estimated the engineering, reliability testing, and product development expenses per platform necessary at each TSL. DOE multiplied the estimate of these development costs per platform by its approximation of the number of platforms available in the United States. For the first three TSLs, the product conversion costs increases are fairly stable. Engineering, testing, and product development costs do not double with each additional switch out because there are efficiencies with doing the redesigns simultaneously (*i.e.*, the testing only has to be completed once). However, there is a large jump in conversion expenses at TSL 4 because there are stamping, material, and other substantial changes to the basic function of each platform. Table 13.4.28 summarizes the breakdown of product conversion costs by TSL for the microwave oven industry.

Table 13.4.28 Energy Factor Product Conversion Costs for the Microwave Oven Industry by TSL

TSL	Total Industry Product Conversion Expenses (2006\$ million)
Baseline	\$0
TSL 1	\$60.0
TSL 2	\$75.0
TSL 3	\$90.0
TSL 4	\$225.0

13.4.9 Markups

To understand how baseline and more efficient products are differentiated, DOE reviewed manufacturer catalogs and utilized information gathered from manufacturers. To

estimate the prices at which manufacturers sell their products, DOE applied markups to the production costs it had developed earlier. DOE considered different markup scenarios for both major product categories (conventional cooking products and microwave ovens. DOE then used markup scenarios to bound the range of expected product prices following new energy conservation standards. For each product class, DOE used the markup scenarios that best characterized the prevailing markups and described the range of market responses manufacturers expect as a result of new energy conservation standards.

After discussions with manufacturers, DOE believes there are two distinct markup scenarios: preservation-of-gross-margin-percentage and preservation of gross margin (in absolute dollars).

13.4.9.1 Preservation of Gross Margin Percentage

The gross margin is defined as revenues less costs of goods sold. Under the preservation-of-gross-margin-percentage scenario, DOE applied a single uniform “gross margin percentage” markup to manufacturing production costs across all efficiency levels. As production costs increase by efficiency level, this scenario implies that the absolute dollar markup will increase also. DOE used a non-production cost markup of 1.26, which includes SG&A expenses; research and development expenses; interest; and profit. This markup is consistent with the one DOE assumed in the base case for the GRIMs. Most manufacturers stated it is optimistic to assume that they could maintain their gross margin percentages despite production cost increases due to energy conservation standards. Therefore, DOE assumes that this scenario represents a high bound to industry profitability under an energy conservation standard.

13.4.9.2 Preservation of Gross Margin (Absolute Dollars)

The implicit assumption behind the “preservation of gross margin (absolute dollars)” markup scenario is that the industry will lower its markups in response to the standards to maintain only its gross margin (in absolute dollars). This means the percentage difference between MPC and selling price will decrease in the standards case compared to the base case and the gross margin percentage will be lower. The industry would do so by passing through its increased production costs to customers, while increased R&D and selling, general, and administrative expenses directly lower profit. DOE implemented this scenario in the microwave oven and conventional cooking products GRIMs by lowering the production cost markups for each TSL to yield approximately the same gross margin in dollars in the standards cases in the year standard are effective (2012) as is yielded in the base case. This scenario represents a low bound to industry profitability under an energy conservation standard.

13.5 CONVENTIONAL COOKING PRODUCTS INDUSTRY FINANCIAL IMPACTS

Using the inputs and scenarios described in the previous sections, the GRIM estimated indicators of financial impacts on the conventional cooking products industry. The following sections detail additional inputs and assumptions related only to cooktops, ovens, and ranges.

The main results of the MIA also reported in this section and consist of two key financial metrics: INPV and annual cash flows.

13.5.1 Impacts on Industry Net Present Value

The INPV measures the industry value and is used in the MIA to compare the economic impacts of different TSLs. The INPV is different from DOE's NPV applied to the whole U.S. economy. The INPV is the sum of all net cash flows discounted at the industry's cost of capital or discount rate. The GRIM estimated cash flows between 2007 and 2042, consistent with the forecast period used in the national impact analysis (chapter 11).

In the MIA, DOE compares the INPV of the base case (no new energy conservation standards) to that of each TSL. The difference between the base case INPV and a standards case INPV is an estimate of the economic impacts that implementing that particular TSL would have on the entire industry. For the conventional cooking products industry, DOE examined the two markup scenarios described in the mark-up section above. Table 13.5.1 through Table 13.5.8 provide the INPV estimates for the conventional cooking products industry under the different scenarios.

Table 13.5.1 Changes in Industry Net Present Value for Electric Cooktops (Preservation of Gross Margin Percentage Markup)

Preservation of Gross Margin Percentage Markup Scenario						
	Units	Base Case	Trial Standard Level			
			1	2	3	4
INPV	(2006 \$ millions)	359	359	357	357	437
Change in INPV	(2006 \$ millions)	-	0	(2)	(2)	78
	(%)	-	0.00%	-0.55%	-0.55%	21.76%

Table 13.5.2 Changes in Industry Net Present Value for Electric Cooktops (Preservation of Gross Margin (Absolute Dollars) Markup)

Preservation of Gross Margin (Absolute Dollars) Markup Scenario						
	Units	Base Case	Trial Standard Level			
			1	2	3	4
INPV	(2006 \$ millions)	359	359	348	348	(26)
Change in INPV	(2006 \$ millions)	-	0	(11)	(11)	(385)
	(%)	-	0.00%	-3.17%	-3.17%	-107.13%

Table 13.5.3 Changes in Industry Net Present Value for Gas Cooktops (Preservation of Gross Margin Percentage Markup)

Preservation of Gross Margin Percentage Markup Scenario						
	Units	Base Case	Trial Standard Level			
			1	2	3	4
INPV	(2006 \$ millions)	288	283	283	283	316
Change in INPV	(2006 \$ millions)	-	(5)	(5)	(5)	28
	(%)	-	-1.73%	-1.73%	-1.73%	9.88%

Table 13.5.4 Changes in Industry Net Present Value for Gas Cooktops (Preservation of Gross Margin (Absolute Dollars) Markup)

Preservation of Gross Margin (Absolute Dollars) Markup Scenario						
	Units	Base Case	Trial Standard Level			
			1	2	3	4
INPV	(2006 \$ millions)	288	276	276	276	189
Change in INPV	(2006 \$ millions)	-	(12)	(12)	(12)	(99)
	(%)	-	-4.11%	-4.11%	-4.11%	-34.45%

Table 13.5.5 Changes in Industry Net Present Value for Electric Ovens (Preservation of Gross Margin Percentage Markup)

Preservation of Gross Margin Percentage Markup Scenario						
	Units	Base Case	Trial Standard Level			
			1	2	3	4
INPV	(2006 \$ millions)	797	797	789	789	788
Change in INPV	(2006 \$ millions)	-	0	(8)	(8)	(9)
	(%)	-	0.00%	-0.98%	-0.98%	-1.17%

Table 13.5.6 Changes in Industry Net Present Value for Electric Ovens (Preservation of Gross Margin (Absolute Dollars) Markup)

Preservation of Gross Margin (Absolute Dollars) Markup Scenario						
	Units	Base Case	Trial Standard Level			
			1	2	3	4
INPV	(2006 \$ millions)	797	797	778	778	326
Change in INPV	(2006 \$ millions)	-	0	(19)	(19)	(471)
	(%)	-	0.00%	-2.43%	-2.43%	-59.07%

Table 13.5.7 Changes in Industry Net Present Value for Gas Ovens (Preservation of Gross Margin Percentage Markup)

Preservation of Gross Margin Percentage Markup Scenario						
	Units	Base Case	Trial Standard Level			
			1	2	3	4
INPV	(2006 \$ millions)	469	461	461	462	422
Change in INPV	(2006 \$ millions)	-	(7)	(7)	(6)	(46)
	(%)	-	-1.56%	-1.56%	-1.36%	-9.91%

Table 13.5.8 Changes in Industry Net Present Value for Gas Ovens (Preservation of Gross Margin (Absolute Dollars) Markup)

Preservation of Gross Margin (Absolute Dollars) Markup Scenario						
	Units	Base Case	Trial Standard Level			
			1	2	3	4
INPV	(2006 \$ millions)	469	459	459	428	287
Change in INPV	(2006 \$ millions)	-	(10)	(10)	(41)	(182)
	(%)	-	-2.10%	-2.10%	-8.68%	-38.74%

13.5.2 Impacts on Annual Cash Flow

While NPV is useful for evaluating the long-term effects of new energy conservation standards, short-term changes in cash flow are also important indicators of the industry's

financial situation. For example, a large investment over a period of one or two years could strain the industry's access to capital. Consequently, the sharp drop in financial performance could cause investors to flee, even though recovery may be near. Thus, a short-term disturbance can have long-term effects that the INPV calculation does not capture. To get an idea of the behavior of annual net cash flows, DOE reports the annual net or free cash flows from 2007 through 2042 for the different TSL levels. Figure 13.5.1 through Figure 13.5.8 present the annual net cash flows for the base case and each of the four TSLs for the conventional cooking products industry assuming the different markup scenarios.

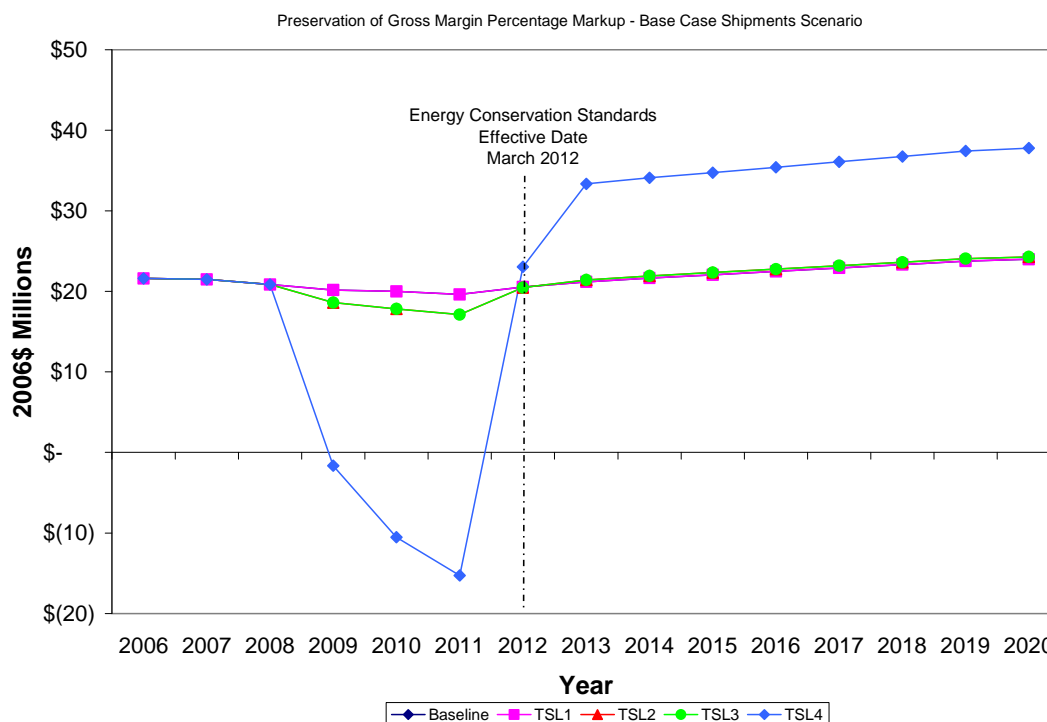


Figure 13.5.1 Annual Net Cash Flows for Electric Cooktops (Preservation of Gross Margin Percentage)

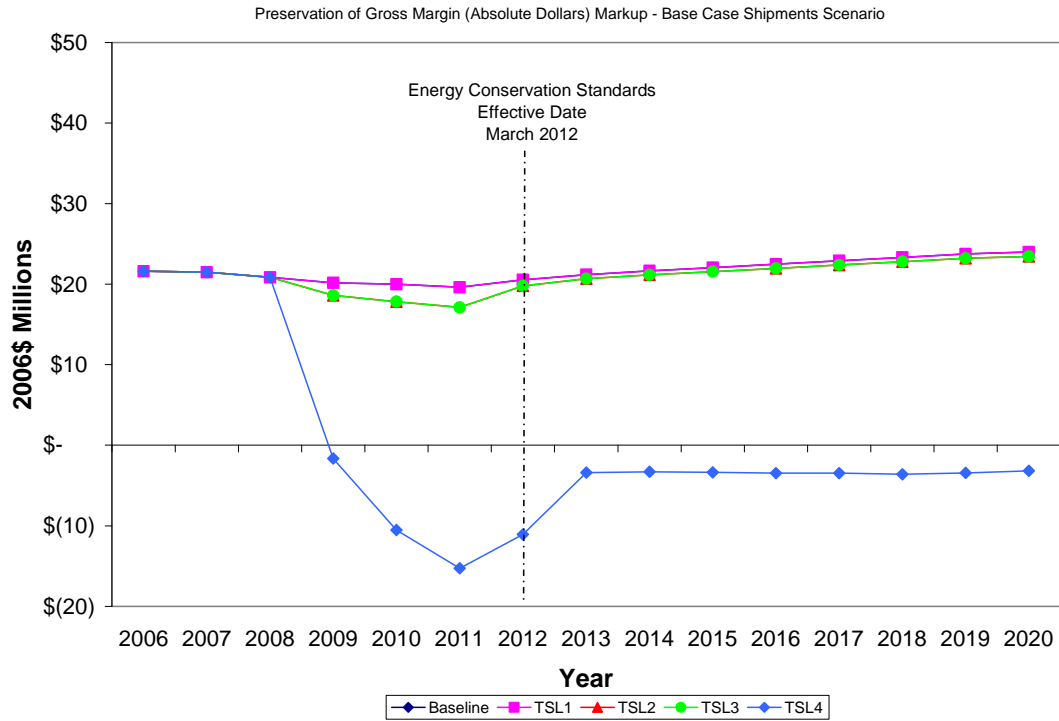


Figure 13.5.2 Annual Net Cash Flows for Electric Cooktops (Preservation of Gross Margin (Absolute Dollars))

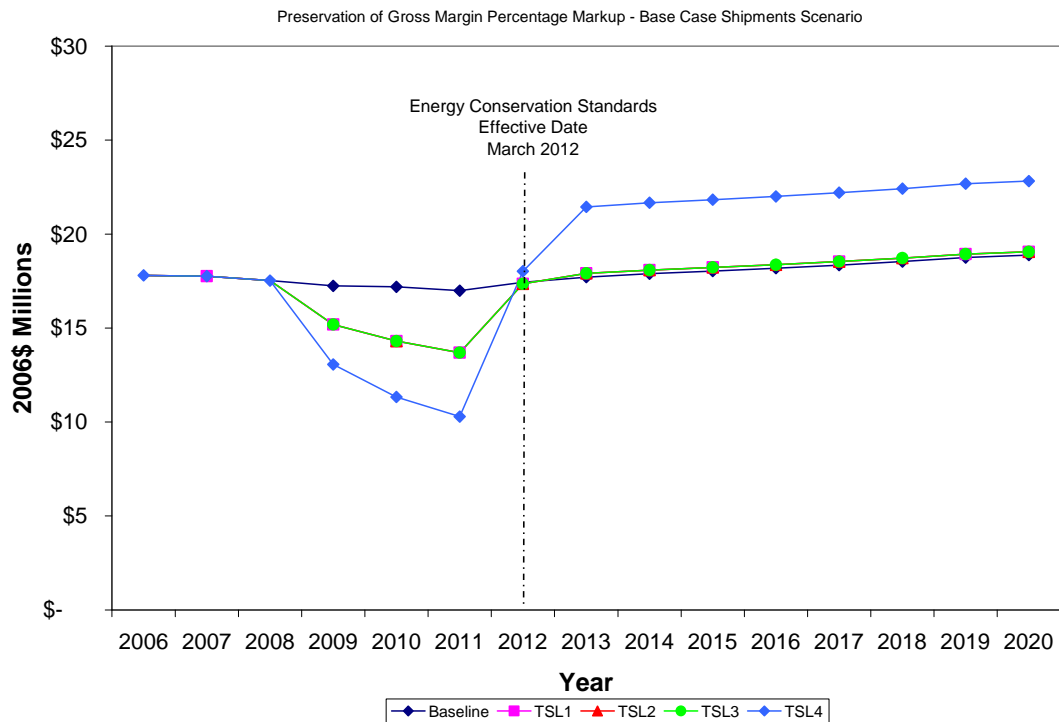


Figure 13.5.3 Annual Net Cash Flows for Gas Cooktops (Preservation of Gross Margin Percentage)

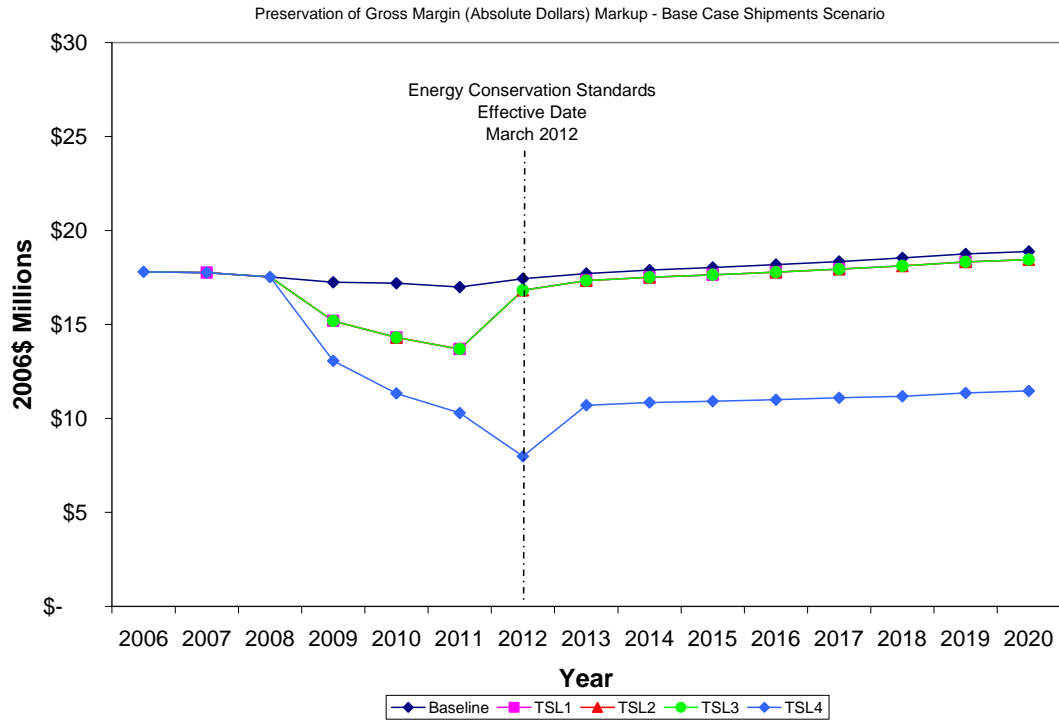


Figure 13.5.4 Annual Net Cash Flows for Gas Cooktops (Preservation of Gross Margin (Absolute Dollars))

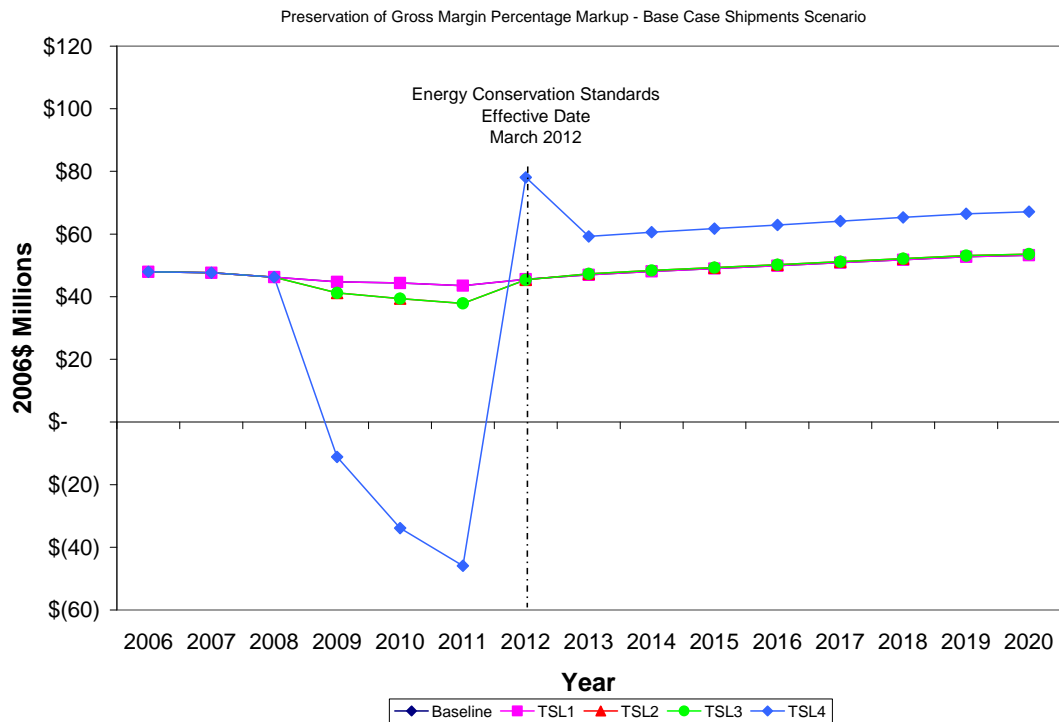


Figure 13.5.5 Annual Net Cash Flows for Electric Ovens (Preservation of Gross Margin Percentage)

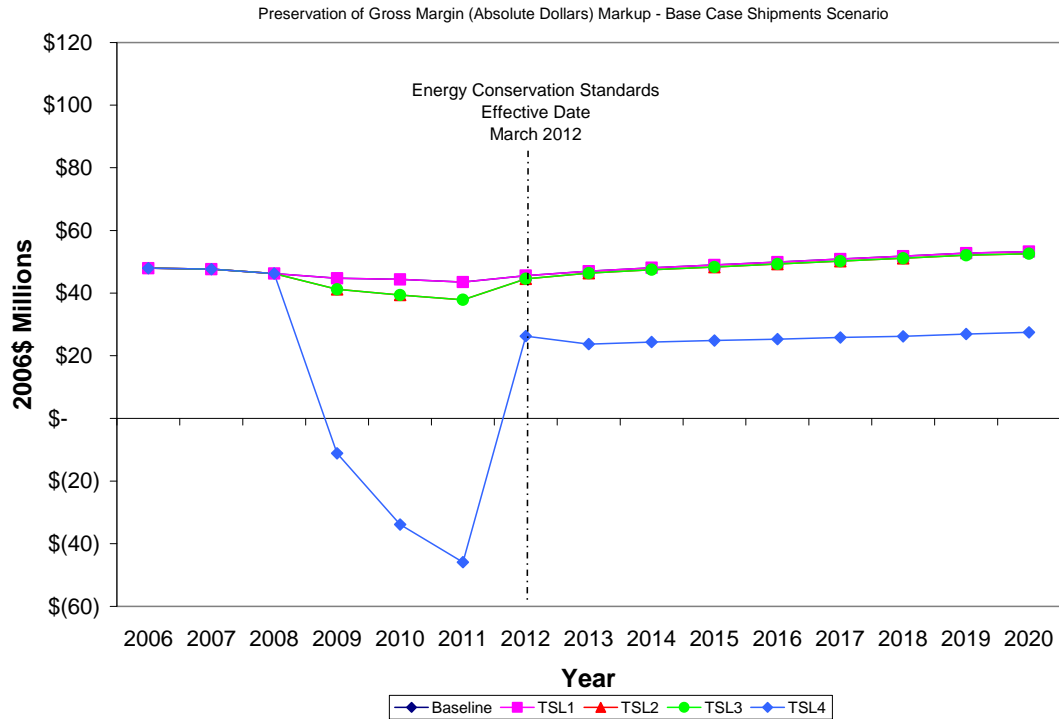


Figure 13.5.6 Annual Net Cash Flows for Electric Ovens (Preservation of Gross Margin (Absolute Dollars))

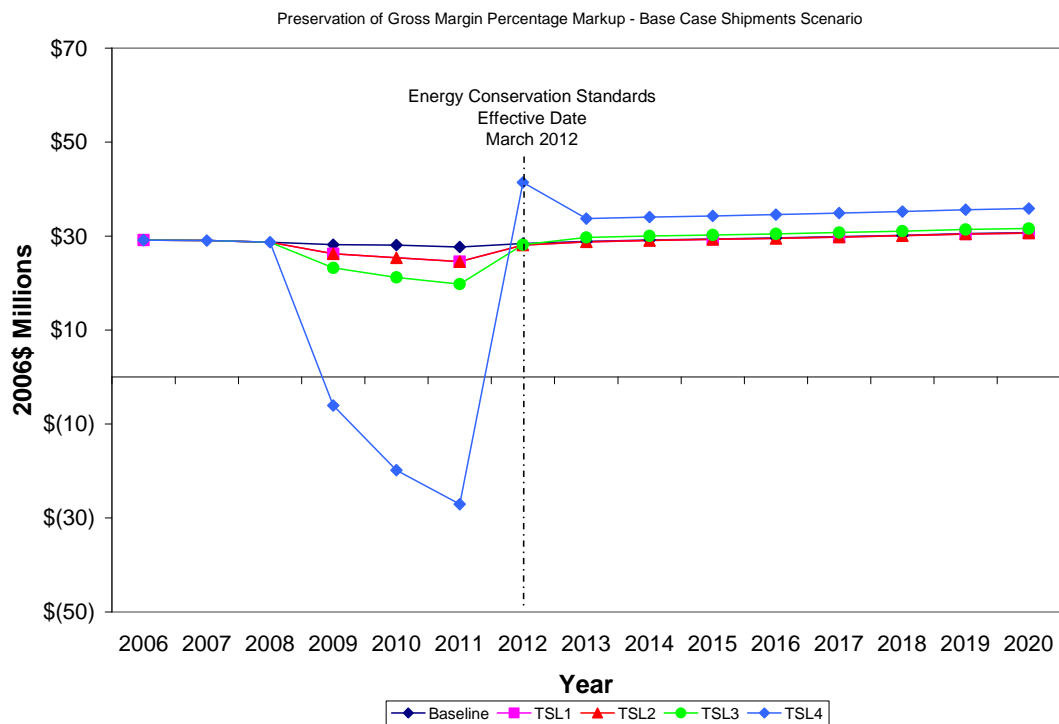


Figure 13.5.7 Annual Net Cash Flows for Gas Ovens (Preservation of Gross Margin Percentage)

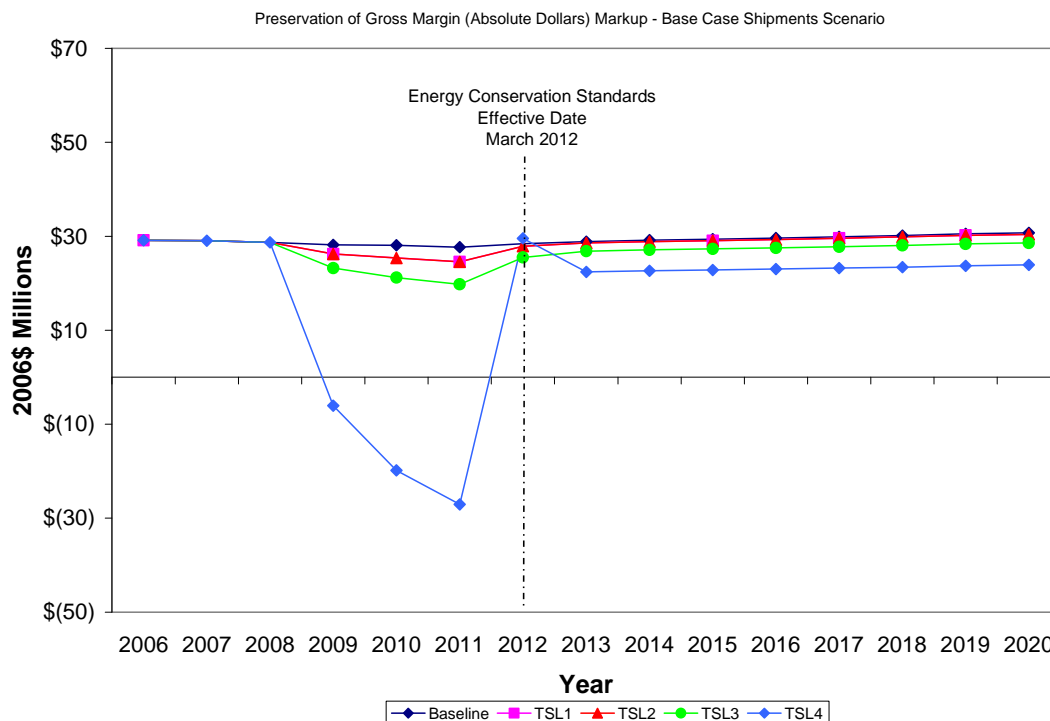


Figure 13.5.8 Annual Net Cash Flows for Gas Ovens (Preservation of Gross Margin (Absolute Dollars))

Prior to the effective date of the new energy conservation standard, cash flows are driven by the level of capital and product conversion costs and the proportion of these investments spent every year. After the standard announcement date, industry cash flows begin to decline as companies use their financial resources to prepare for the new standard. The more stringent the energy conservation standard, the greater the impact on industry cash flows in the years running up to the effective date, as product conversion and capital conversion costs depress cash flows from operations. In addition to capital conversion and product conversion costs, manufacturers may also have to write down the value of existing tooling, equipment, and intellectual property whose value is impacted by an efficiency standard.

Efficiency standards have the potential of creating stranded assets, *i.e.* tools, equipment, and even intellectual property that would have enjoyed longer use, if the efficiency standard had not made them obsolete. For example, if a manufacturer has a stamping die for a gas cooktops which can only be used with standing pilot ignition systems, then a ban on standing pilot ignition systems could make the die functionally obsolete well before it used up from actual use. Similarly, a patent on a particular type of standing pilot ignition system potentially loses any residual value once its target market disappears.

For all conventional cooking products, TSL 1 through TSL 3 have similar impacts in the years prior to the effective date because these TSLs all have relatively low capital and product conversion costs compared to industry revenues. These expenses are large for many products at TSL 4, creating a large, negative cash flow for many conventional cooking products at this TSL.

In the preservation of gross margin percentage markup scenario, a one time write-down on stranded assets yields a tax shield that increases cash flows from operations for electric and gas ovens.

In the years following the standard, the impact on cash flow depends on the operating revenue. Higher TSLs have a positive impact on cash flows relative to the base case if manufacturers are able to fully pass along costs to consumers (the preservation of gross margin percentage markup scenario) and lower cash flow relative to the base case if manufacturers can only recover a portion of their increased costs (the preservation of gross margin in absolute dollars markup scenario). The magnitude of the positive cash flow impact under the preservation of gross margin percentage scenario and the negative cash flow impact under the preservation of gross margin (absolute dollars) scenario depends on the incremental cost of standards compliant products. The higher the relative cost, the larger the impact on operating revenue and cash flow in the years following the effective date of the standard.

13.6 MICROWAVE OVEN INDUSTRY FINANCIAL IMPACTS

Using the inputs and assumptions described in the previous sections, the GRIM produced indicators of financial impacts on the microwave oven industry. The following sections detail additional inputs relating only to microwave ovens, including the main MIA results for such ovens: INPV, and annual cash flows.

13.6.1 Impacts on Industry Net Present Value

As previously stated, the INPV measures the industry value and is used in the MIA to compare the economic impacts of different TSLs. For the microwave ovens industry, the GRIM estimated cash flows between 2007 and 2042, consistent with the forecast period used in the national impact analysis (chapter 11).

In the MIA, DOE compares the INPV of the base case (no new energy conservation standards) to that of each TSL. The difference between the base case INPV and a standards case INPV is an estimate of the economic impacts that implementing that particular TSL would have on the entire industry. For the microwave oven industry, DOE examined the two markup scenarios described in the mark-up section above. Table 13.6.1 through Table 13.6.2 provide the NPV estimates for the microwave oven industry under the different scenarios.

Table 13.6.1 Energy Factor Changes in Industry Net Present Value for Microwave Ovens (Preservation of Gross Margin Percentage Markup)

Preservation of Gross Margin Percentage Markup Scenario						
	Units	Base Case	Trial Standard Level			
			1	2	3	4
INPV	(2006 \$ millions)	1,456	1,501	1,575	1,695	1,726
Change in INPV	(2006 \$ millions)	-	45	118	238	270
	(%)	-	3.06%	8.11%	16.37%	18.53%

Table 13.6.2 Energy Factor Changes in Industry Net Present Value for Microwave Ovens (Preservation of Gross Margin (Absolute Dollars) Markup)

Preservation of Gross Margin (Absolute Dollars) Markup Scenario						
	Units	Base Case	Trial Standard Level			
			1	2	3	4
INPV	(2006 \$ millions)	1,456	1,256	1,068	778	285
Change in INPV	(2006 \$ millions)	-	(200)	(388)	(679)	(1,171)
	(%)	-	-13.75%	-26.64%	-46.60%	-80.42%

13.6.2 Impacts on Annual Cash Flow

To review the behavior of annual net cash flows, DOE reports the annual net or free cash flows from 2007 through 2042 for the different TSL levels. Figure 13.6.1 and Figure 13.6.2 present the annual net cash flows for the base case and each TSL for the microwave oven industry assuming the different markup scenarios.

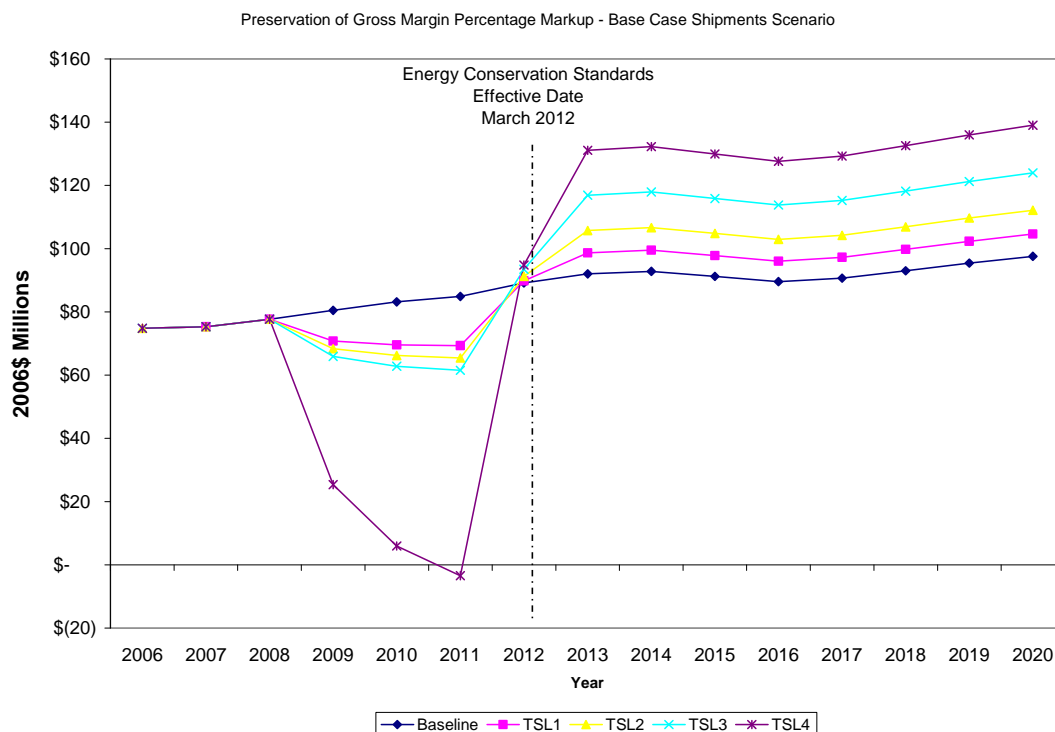


Figure 13.6.1 Energy Factor Annual Net Cash Flows for the Microwave Oven Industry (Preservation of Gross Margin Percentage Markup)

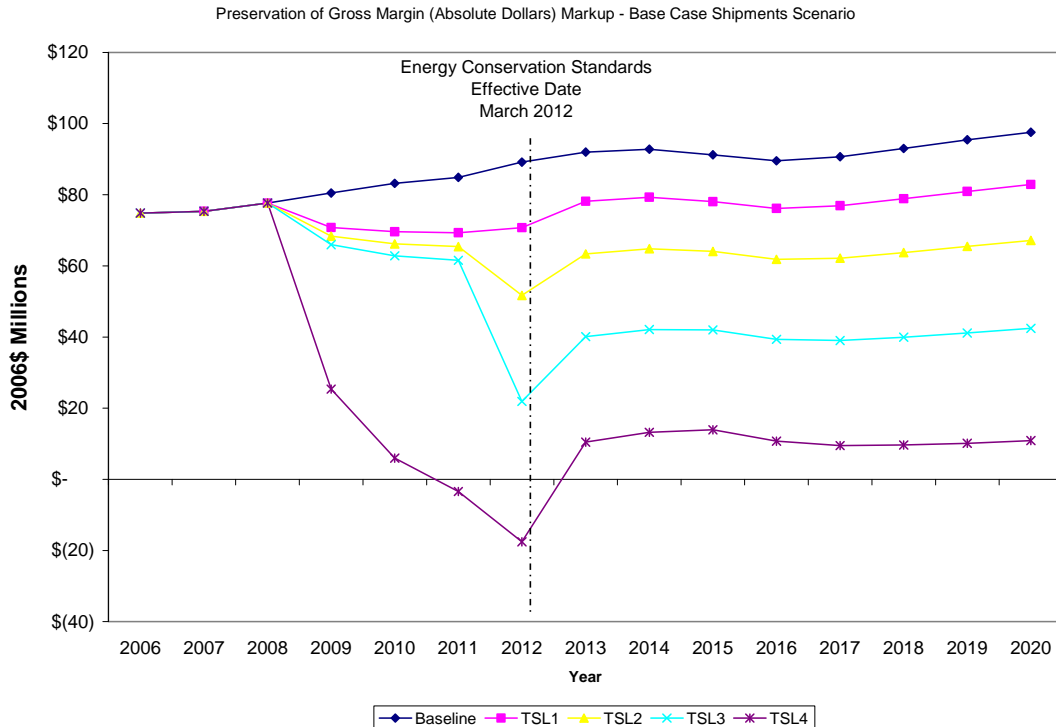


Figure 13.6.2 Energy Factor Annual Net Cash Flows for the Microwave Oven Industry (Preservation of Gross Margin (Absolute Dollars) Markup)

Prior to the effective date of the new energy conservation standard, cash flows are driven by the level of capital and product conversion costs and the proportion of these investments spent every year. After the standard announcement date, industry cash flows begin to decline as companies use their financial resources to prepare for the new standard. As expected, the more stringent the energy conservation standard, the greater the impact on industry cash flows in the years prior to the effective date. In the years before a standard becomes effective, capital and product conversion costs depress cash flows from operations. Since the capital and conversion costs are the same regardless of the markup scenario, the impacts in the years prior to the effective date of the standards are similar for both scenarios. Since DOE assumed that standards compliant microwave ovens would be based on existing products, no capital assets are stranded due to standards. Consequently, there is not a one time injection of cash in the year of the standards from a write-down.

The markup scenario has a large impact on cash flows in the year the standard takes effect. The preservation of gross margin percentage scenario immediately restores the cash flow to levels similar to the base case in the year the standard takes effect. Higher selling prices increase operating profit and increase cash flow due to a higher depreciation expense. Since depreciation is a non-cash expense, it does not require an outflow of cash but does lower operating profit. Therefore, this expense gets added back to cash flow. For the preservation of gross margin (absolute dollar) scenario, cash flow decreases in 2012 because operating profit decreases as manufacturers cannot fully pass on all increased expenses. In addition, since revenue increases greatly that year, there is a one-time need to boost working capital, lowering cash flow for 2012 only.

After 2012, higher TSLs have a positive impact on cash flows relative to the base case if manufacturers are able to fully pass along costs to consumers (the preservation of gross margin percentage markup scenario) and lower cash flow relative to the base case if manufacturers can only recover a portion of their increased costs (the preservation of gross margin in absolute dollars markup scenario).

The magnitude of the positive cash flow impact under the preservation of gross margin percentage scenario and the negative cash flow impact under the preservation of gross margin (absolute dollars) scenario depends on the incremental cost of standards compliant products. The higher the relative cost, the larger the impact on operating revenue and cash flow in the years following the effective date of the standard. Since the incremental costs are fairly large, the positive impacts on cash flow under the preservation of gross margin percentage markup scenario and the negative impacts on cash flow under the preservation of gross margin (absolute dollars) scenario are significant.

13.7 IMPACTS ON COOKING PRODUCTS SMALL BUSINESSES

DOE identified three manufacturers of gas-fired ovens, stoves, and cooktops with standing pilot lights. Two of the three manufacturers are classified as small businesses by the SBA, while the third is a large, diversified appliance manufacturer. DOE found some differences in the R&D emphasis and marketing strategies between small business manufacturers and large manufacturers. These two smaller businesses tend to focus on appliance sizes not offered by larger manufacturers.

During the MIA, DOE contacted both small businesses and one of them agreed to be interviewed. DOE characterized the businesses based on this interview and D&B reports for both companies. The two small cooking businesses are privately held and each employs less than 300 employees.^b Both businesses manufacture only residential cooking appliances. One of these appliance manufacturers produces just ranges, while the other produces cooktops, ranges, hoods, wall ovens, and cooking ventilation equipment. Both companies have annual revenues of less than \$60 million.

DOE found that, as it pertains to the elimination of standing pilots, small manufacturers shared many of the same concerns as the large manufacturer. The large and small companies are concerned that eliminating standing pilots could leave some customers without access to electricity without alternatives. For example, certain religious groups and remote areas (hunting cabins) would be forced to prolong the life of existing products. In addition, customers that currently use standing pilots could be forced to install an electrical outlet near a standards-compliant stove. These manufacturers expected a decrease in revenues as existing customers prolong the lifetime of existing products when forced with a costly installation or no viable alternative.

^b The SBA classifies a residential cooking appliance manufacturer as a small business if it has less than 750 employees. Refer to: http://www.sba.gov/idc/groups/public/documents/sba_homepage/serv_sstd_tablepdf.pdf

Though the small manufacturers shared many of the concerns as the large manufacturer, the small businesses will be much more impacted by a standard that eliminates standing pilots. The two small businesses indicated that 25 percent or more of their entire production consists of such niche products, now that most manufacturers have switched to electronic ignition in their gas-fired cooking appliances. In addition to the elimination of standing pilots, any rule affecting products manufactured by these small businesses will impact them disproportionately because of their size and their focus on cooking appliances. However, due to the low number of competitors that agreed to be interviewed, DOE could not characterize this industry segment with a separate cash-flow analysis due to concerns about maintaining confidentiality.

At TSL 1 for gas-ovens and gas cooktops, the elimination of standing pilot lights would eliminate one of the niches that these two small businesses serve in the cooking appliance industry. Both businesses also manufacture ovens and cooktops with electronic ignition systems, but the ignition source would no longer be a differentiator within the industry as it is today. The result would be a potential loss of market share since consumers would be able to choose from a wider variety of competitors, all of which operate at much higher production scales.

For all other TSLs concerning conventional cooking appliances, the impact on small, focused business entities will be proportionately greater than for their competitors since these businesses lack the scale to afford significant R&D expenses, capital expansion budgets, etc. DOE could not gauge the extent of the difference since manufacturers did not respond to all proposed investment requirements by TSL during interviews. However, research associated with other small entities in prior rulemakings suggests that many costs associated with complying with rulemakings are fixed, regardless of production volume.

Since all domestic manufacturers already manufacture all of their conventional cooking appliances with electronic ignition modules as a standard feature or as an option for consumers, the cost of converting the remaining three domestic manufacturers exclusively to electronic ignition modules would be modest. However, given their focus and scale, any conventional cooking appliance rule will affect these two domestic small businesses disproportionately compared to their larger and more diversified competitor.

13.8 OTHER IMPACTS

13.8.1 Employment

13.8.1.1 Methodology

To quantitatively assess the impacts of energy conservation standards on cooking product manufacturing employment, DOE used the GRIM to estimate the domestic labor expenditures and number of employees in the base case and at each TSL from 2007 through 2042 for the conventional cooking products and microwave oven industries. DOE used statistical data from the U.S. Census Bureau's 2006 ASM and 2006 CIR, the results of the engineering analysis, and interviews with manufacturers to estimate the inputs necessary to calculate industry-wide labor expenditures and domestic employment levels.

DOE constructed the industry cost structure using publicly available information from the 2006 ASM and SEC 10-K reports filed by publicly owned manufacturers. The labor percentage of the industry cost structure is calculated by dividing total production worker wages by the total value of shipments. For cooking products, which covers both conventional cooking products and microwave ovens, DOE used the same industry cost structure constructed from 2006 ASM data classified under NAICS 335221 (household cooking appliance manufacturing). The labor percentage and other components of the industry cost structure for cooking products are shown in Figure 13.8.1 below.

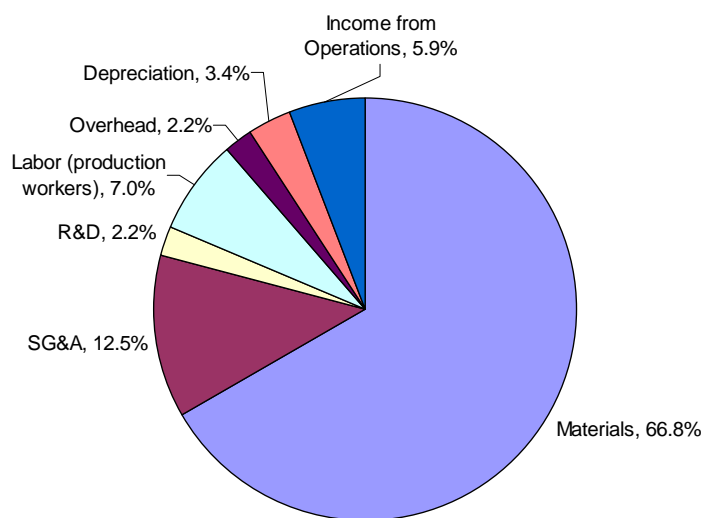


Figure 13.8.1 Cooking Products Industry Cost Structure

To determine the total annual labor expenditure on production labor, the value of production labor in the industry cost structure was converted to a percentage of the cost of goods sold (COGS). In the GRIMs, the labor expenditures in each year are calculated by multiplying the COGS or MPCs by the labor percentage of COGS. As a result, higher TSLs have greater direct labor costs because more efficient products have higher MPCs.

To calculate the annual domestic labor expenditures, DOE used the 2006 CIR to estimate the percentage of domestic production in each industry. DOE estimated that approximately 27 percent of conventional cooking products and 4 percent of microwave ovens are manufactured and sold in the United States.

DOE multiplied the total annual labor expenditures in the GRIM by the percentage of U.S. production for domestic consumption to calculate domestic labor expenditures for production labor in each industry. The domestic annual labor expenditures in the GRIMs were converted to domestic production employment levels by dividing production labor expenditures by the annual payment per production worker (production worker hours times the labor rate

found in the 2006 ASM).^c The number of non-production employees was calculated by multiplying the number of production workers by the ratio of non-production workers to production workers calculated using the employment data in the 2006 ASM.

The domestic annual labor expenditures and employment levels were calculated for the base case and at each TSL. The impacts on domestic employment due to standards can be assessed by comparing the employment results in the base case to the results at each TSL. In all GRIMs, the employment results represent U.S. production workers that are impacted by this rulemaking. U.S. workers involved in manufacturing or supporting products for exports would not be impacted and are not included as part of the labor impacts.

13.8.1.2 Conventional Cooking Products

The GRIM calculates that the conventional cooking products industry's domestic labor expenditure for production labor in 2012 is approximately \$57 million (total COGS in 2012 times the production labor percentage of COGS times the percentage of U.S. production). Using the \$13.84 wage rate and 1,940 production hours per year per employee found in the 2006 ASM, the GRIM estimates there are approximately 2,120 U.S. production employees involved in manufacturing conventional cooking products covered by this rulemaking. In addition, DOE estimates that 278 non-production employees in the United States support conventional cooking product production^d. The employment spreadsheet of the conventional cooking products GRIM shows the annual domestic employment impacts in further detail.

Table 13.8.1 illustrates the impact of new energy conservation standards on domestic employment levels at each TSL for the conventional cooking products industry calculated by the GRIM.

^c 2006 ASM labor rates and production hours per year per employee are very similar to figures reported in the engineering analysis. DOE used 2006 ASM figures to ensure a consistent set of publicly available data is used for the manufacturing employment analysis.

^d As defined in the 2006 ASM, production workers number include "workers (up through the line-supervisor level) engaged in fabricating, processing, assembling, inspecting, receiving, storing, handling, packing, warehousing, shipping (but not delivering), maintenance, repair, janitorial and guard services, product development, auxiliary production for plant's own use (*e.g.*, power plant), recordkeeping, and other services closely associated with these production operations at the establishment covered by the report. Employees above the working-supervisor level are excluded from this item." Non-production workers are defined as "employees of the manufacturing establishment including those engaged in factory supervision above the line-supervisor level. It includes sales (including driver-salespersons), sales delivery (highway truck drivers and their helpers), advertising, credit, collection, installation and servicing of own products, clerical and routine office functions, executive, purchasing, financing, legal, personnel (including cafeteria, medical, etc.), professional, and technical employees. Also included are employees on the payroll of the manufacturing establishment engaged in the construction of major additions or alterations utilized as a separate work force."

Table 13.8.1 Conventional Cooking Products Industry Estimated Employment Impacts in 2012

Trial Standard Level	Base Case	TSL 1	TSL 2	TSL 3	TSL 4
Total Number of Domestic Conventional Cooking Products Production Employees in 2012	2,120	2,127	2,137	2,154	2,698
Change in Total Number of Domestic Conventional Cooking Products Production Employees in 2012 Due to Standards	-	7	17	34	577
Total Number of Domestic Conventional Cooking Products Non-Production Employees in 2012	278	279	280	283	354
Total Number of Domestic Conventional Cooking Products Employees in 2012	2,398	2,406	2,418	2,437	3,051

Figure 13.8.2 shows total annual domestic employment levels for each TSL calculated by the GRIM.

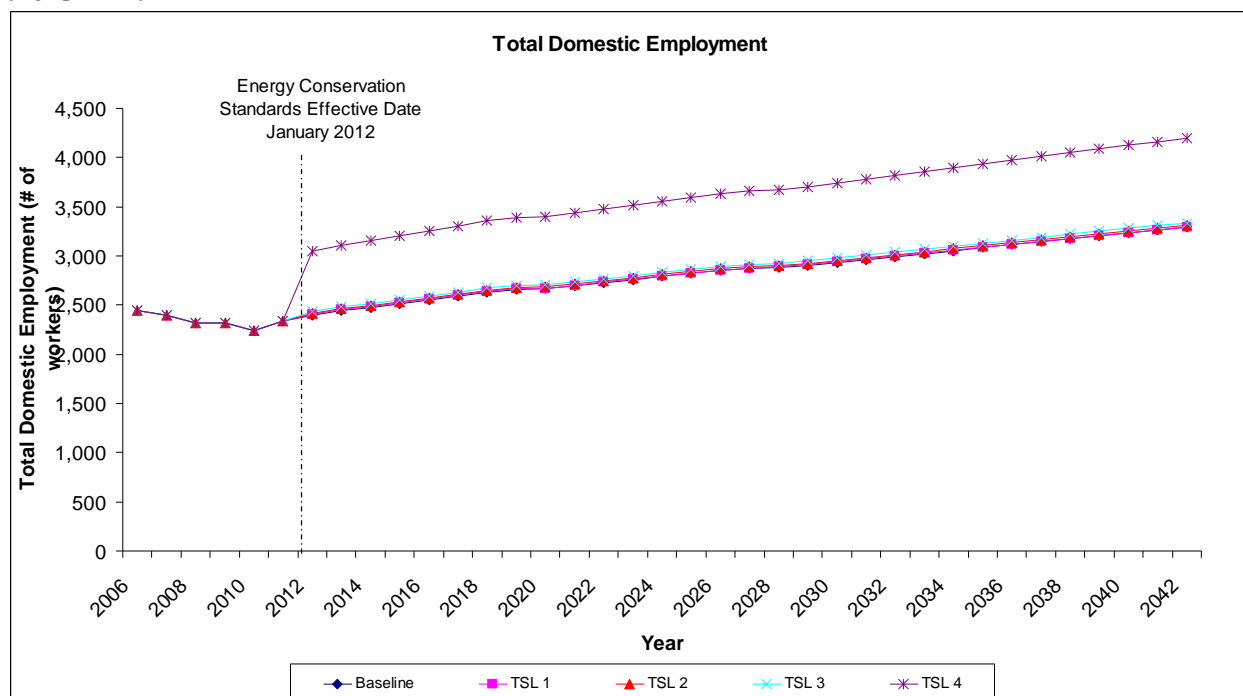


Figure 13.8.2 Total Conventional Cooking Products Industry Domestic Employment by Year

Currently, approximately 27 percent of conventional cooking products sold in the United States are manufactured in the United States. DOE expects that there would be positive employment impacts among domestic conventional cooking products manufacturers for TSL 1 through TSL 4. Because production employment expenditures are assumed to be a fixed percentage of COGS and the MPCs increase with more efficient products, labor tracks the increased prices in the GRIM. The GRIM predicts a gradual increase in domestic employment after standards.

The results predicted in the GRIM potentially overstate the domestic employment impacts. From the engineering analysis, higher TSLs correspond to switches to more efficient components. Because many components are sourced for both large and small manufacturers, labor is more a function of units shipped, not production costs as calculated in the GRIM. For these manufacturers, the greater labor expenditures for more efficient components are born by their suppliers. However, since shipments are expected to increase gradually over time in the shipments model, employment levels for manufacturers of cooking products would still increase at all TSLs.

For TSL 1 through TSL 3, the GRIM employment results do not overstate the impacts and agree with the bottoms-up analysis in the engineering analysis. The incremental costs for more efficient components at these TSLs are relatively small. In response to standards, manufacturers would most likely not alter employment levels significantly because inserting a more efficient component does not necessarily require more labor.

At TSL 4 the GRIM may overstate the employment impacts. The incremental costs for components are large at TSL 4, making the employment impacts more substantial. It is likely that the large, positive impacts in employment due to the incremental cost increase overstate the impacts that would result from increased shipments over time. This overstatement is caused by the assumption of constant labor content as a percentage of revenue. For TSL 4 in particular, the design options involve component substitution which substantially increase the cost of purchase parts but should not result in a proportionate increase in labor costs.

The employment conclusions ignore the possible relocation of domestic jobs to lower-labor-cost countries, which may occur independently of new standards or may be influenced by the level of investments required by new standards. Because the labor impacts in the GRIM do not take relocation into account, the labor impacts would be different if manufacturers chose to relocate to lower cost countries. The relatively small capital costs at TSL 1 through TSL 3 make relocation less likely. However, at all TSLs manufacturers face significant product conversion costs that correspond to redesigning products and testing components on all platforms. These significant conversion costs put pressure on manufacturers at all TSLs to cut costs. At TSL 4, manufacturers face both significant capital and product conversion costs, which put even greater pressure on cost reduction and for plant relocation to lower-cost countries.

13.8.1.3 Microwave Ovens

The GRIM calculates that the domestic industry labor expenditure for microwave oven production workers in 2012 is approximately \$6 million. Using the \$13.84 wage rate and 1,940 production hours per year per employee found in the 2006 ASM, the GRIM estimates there are approximately 228 U.S. production employees involved in manufacturing microwave ovens covered by this rulemaking (total COGS in 2012 times the production labor percentage of COGS times the percentage of U.S. production). In addition, DOE estimates that 30 indirect employees in the United States support microwave oven production. The employment spreadsheet of the microwave oven GRIM shows the annual domestic employment impacts due to new energy conservation standards in further detail.

Table 13.8.2 illustrates the impact of new cooking efficiency standards on employment levels at each TSL for the microwave oven industry calculated by the GRIM.

Table 13.8.2 Microwave Ovens Industry Estimated Employment Impacts in 2012 for Energy Factor Standards

Trial Standard Level	Base Case	TSL 1	TSL 2	TSL 3	TSL 4
Total Number of Domestic Microwave Oven Production Employees in 2012	228	244	262	289	325
Change in Total Number of Domestic Microwave Oven Production Employees in 2012 Due to Standards	-	16	34	62	97
Total Number of Domestic Microwave Oven Non-Production Employees in 2012	30	32	34	38	43
Total Number of Domestic Microwave Oven Employees in 2012	258	276	296	327	367

Figure 13.8.3 shows annual domestic employment levels for each TSL calculated by the GRIM for energy factor standards.

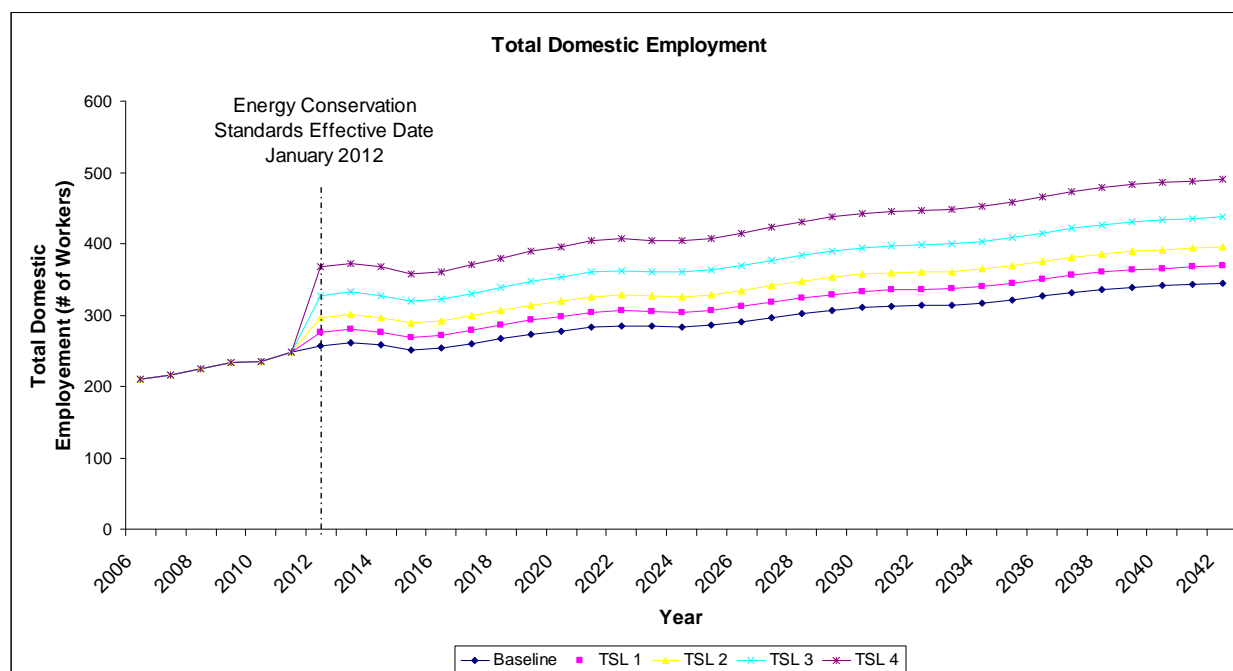


Figure 13.8.3 Total Microwave Oven Industry Domestic Employment by Year for Energy Factor Standards.

Approximately 96 percent of microwave ovens sold in the United States are imported. Because most microwave ovens are produced abroad, any new energy conservation standard has a larger impact on labor in other countries. U.S. companies are all still impacted by the product conversion costs, capital conversion costs, and higher MPCs. However, the impacts of standards on domestic employment would be small.

From the engineering analysis, higher TSLs correspond to switches to more efficient components. Because many components are sourced for both large and small manufacturers, labor is more a function of units shipped, not production costs as calculated in the GRIM. However, since shipments are expected to increase gradually over time in the shipments model, employment levels for manufacturers of microwave ovens would still increase at all TSLs.

For all TSLs, the GRIM calculates an increase in domestic employment due to new energy conservation standards because production labor expenditures are assumed to be a fixed percentage of COGS and MPCs increase with more efficient products. For all TSLs, the GRIM employment results agree with the bottoms-up analysis in the engineering. However, the incremental costs for more efficient components at all TSLs are relatively small. Consequently, in response to standards, domestic manufacturers would most likely not alter employment levels much because inserting a more efficient component does not necessarily require more labor.

The employment conclusions ignore the possible relocation of domestic jobs to lower-labor-cost countries, which may occur independently of new standards or may be influenced by the level of investments required by new standards. Since most microwave ovens are already imported and the employment impacts in the GRIM are small, the actual impacts on domestic employment would be mostly impacted if any U.S. manufacturer decided to shift remaining U.S. production to lower-cost-countries.

13.8.2 Production Capacity

13.8.2.1 Conventional Cooking Products Production Capacity Impacts

According to the manufacturers of gas cooking products, new energy conservation standards should not significantly affect production capacity, except at the max-tech levels. For example, in interviews, all manufacturers of cooking products with standing pilot lights stated they also manufacture products that do not use this type of ignition. Since manufacturers of gas cooking appliances with standing pilot ignitions typically also sell otherwise-identical appliances with electronic ignition systems, manufacturers stated that they expected impacts on manufacturing capacity due to changes in the ignition systems to be minimal. Thus, DOE believes manufacturers will be able to maintain manufacturing capacity levels and continue to meet market demand under new energy conservation standards. For most other products and efficiencies, manufacturers can modify existing equipment to accommodate redesigned products with more efficient components without significantly impacting production volumes.

However, max-tech levels for standard electric ovens and standard gas ovens strand some existing manufacturing equipment and tooling, and would require substantial product development and retooling. DOE believes setting a standard at this level could lead to short term capacity problems for these products if manufacturers cannot make the tooling changes in time to meet the standard. For the other efficiencies, manufacturers will be able to retool without causing capacity constraints.

13.8.2.2 Microwave Oven Production Capacity Impacts

According to the majority of microwave oven manufacturers, new energy conservation

standards will not significantly affect production capacity. As with conventional cooking products, any necessary microwave oven redesigns involve component switches that will not change the fundamental assembly of the equipment. However, manufacturers anticipate significant changes to tooling for TSL 4. For all efficiency levels, the most significant conversion costs are the research and development (R&D), testing, and certification of products with more-efficient components, which does not affect production line capacity. Thus, DOE believes manufacturers will be able to maintain manufacturing capacity levels and continue to meet market demand under new energy conservation standards.

13.8.3 Cumulative Regulatory Burden

While any one regulation may not impose a significant burden on manufacturers, the combined effects of several impending regulations may have serious consequences for some manufacturers, groups of manufacturers, or an entire industry. Assessing the impact of a single regulation may overlook this cumulative regulatory burden. For the cumulative regulatory burden analysis, DOE describes other significant product-specific regulations that could affect conventional cooking products and microwave oven manufacturers that will take effect three years before or three years after the effective date of the new energy conservation standards for these products^e.

Companies which produce a wide range of regulated products may be faced with more capital and product development expenditures than competitors with a narrower scope of products. Regulatory burdens can prompt companies to exit the market or reduce their product offerings, potentially reducing competition. Especially smaller companies can be impacted by regulatory costs since such companies have lower sales volumes over which they can amortize the costs of meeting new regulations. DOE considers that a proposed standard is not economically justified if it contributes to an unacceptable level of cumulative regulatory burden.

In addition to the energy conservation regulations on conventional cooking products and microwave ovens, several other Federal regulations and pending regulations apply to these products and other equipment produced by the same manufacturers. DOE recognizes that each regulation can significantly impact manufacturers' financial operations. The following sections provide a qualitative discussion of some of these regulations and standards.

13.8.3.1 Standby Power Requirements

Section 310 of the Energy Independence and Security Act of 2007 (EISA 2007) (Pub. L. No. 110-140) amends Section 325 of the Energy Policy and Conservation Act (EPCA) of 1975 (42 U.S.C. 6291–6309) to require DOE to regulate standby mode and off mode energy consumption as part of an energy conservation standard for all covered products, including residential ranges and ovens and microwave ovens, for which a final rule is adopted after July 10, 2010. (42 U.S.C. 6295(gg)(1)(A)) For this rulemaking, EISA 2007 specifies that the test procedure for residential ranges and ovens and microwave ovens be amended to include

^e The effective date for conventional cooking products and microwave ovens is three years from the date of publication of the final rule.

measurement of standby mode and off mode energy consumption, taking into consideration the most current version of International Electrotechnical Commission's (IEC) Standard 62301 Household electrical appliances – Measurement of standby power (IEC Standard 62301). (42 U.S.C. 6295(gg)(2)(A)) According to EISA 2007, an energy conservation standard for cooking products that would be put forth from this rulemaking is not required to incorporate standby mode and off mode energy consumption.

Besides the test procedure change for products in this rulemaking, manufacturers stated a concern with the EISA 2007 requirement that all covered products measure standby power and off mode. As discussed in the final rule, DOE is not considering standby power requirements for this rulemaking. However, manufacturers stated that this requirement will impose a heavy burden on their testing facilities going forward. In addition, because the test procedure change will affect all covered products, manufacturers expressed a concern that this had the potential to create many overlapping regulatory compliance costs in the future.

13.8.3.2 Additional Federal Energy Conservation Standards

Besides the energy conservation regulations on conventional cooking products and microwave ovens, several other Federal regulations and pending regulations apply to other products and equipment produced by the same manufacturers. DOE recognizes that each regulation can significantly impact manufacturers' financial operations. Multiple regulations affecting the same manufacturer can quickly strain manufacturers' profits and possibly cause an exit from the market. Table 13.8.3 list the Federal regulations that could also affect manufacturers of the conventional cooking products and microwave oven industries in the three years leading up to and the three years preceding the effective date of the new energy conservation standards for these products. It must be noted that while the list of products is long, the amount of cumulative burden on any particular firm is extremely variable since the product scope of each company is different.

Table 13.8.3 Other DOE and Federal Actions Affecting the Cooking Products Industry (Conventional Cooking Products and Microwave Ovens)

Regulation	Approximate Effective Date*	Number of Impacted Companies from the MTA	Estimated Industry Total Conversion Expenses** (millions)
Residential Refrigerators and Freezers	2010*	18	N/A [†]
Residential Clothes Washers	2014*	14	N/A [†]
Dishwashers	2012	14	N/A [†]
Room Air Conditioners	2014*	9	N/A [†]
Battery Chargers	2014*	5	N/A [†]
Dehumidifiers	2012	4	N/A [†]
Residential Furnaces	2015*	3	\$97 (2006\$) ^f
Commercial Clothes Washers	2012*	3	N/A [†]
Packaged Terminal Air Conditioners and Heat Pumps	2012*	3	N/A [†]
External Power Supplies	2014*	3	N/A [†]
Residential Fluorescent and Incandescent Lamps	2012*	2	N/A [†]
Residential Water Heaters	2015*	2	N/A [†]
Commercial Beverage Vending Machine	2012*	2	N/A [†]
Commercial Refrigeration Equipment	2012*	2	\$112 (2007\$) ^g
Commercial Unitary Air Conditioners and Heat Pumps	2010	2	N/A [†]
Ceiling Fans and Ceiling Fan Light Kits	2010	1	N/A [†]
Commercial Distribution Transformers	2010	1	\$13.5 (2006\$) ^h

*The dates listed are an approximation. The exact dates are pending final DOE action.

** Total conversion costs include both capital and product conversion costs for the rulemaking specific industries.

† For energy conservation standards for ongoing rulemakings that are awaiting DOE final action, DOE does not have finalized estimated total industry conversion expense. For minimum performance requirements prescribed by the Energy Policy Act of 2005 (EPACT 2005), DOE did not estimate total industry conversion expenses because an

^f Estimated industry conversion expenses were published in the TSD for the November 2007 residential furnace final rule. 72 FR 65136 (Nov. 19, 2007). The TSD for the 2007 residential furnace final rule can be found at: http://www1.eere.energy.gov/buildings/appliance_standards/residential/furnace_boiler_fr.html

^g Estimated industry conversion expenses were published in the TSD for the August 2008 commercial refrigeration equipment NOPR. 73 FR 50072, 50119 (Aug. 25, 2008). The TSD for the 2008 commercial refrigeration equipment NOPR can be found at:

http://www1.eere.energy.gov/buildings/appliance_standards/commercial/refrig Equip_nopr.html

^h Estimated industry conversion expenses were published in the TSD for the October 2007 distribution transformers final rule. 72 FR 58190 (Oct. 12, 2007). The TSD for the 2007 distribution transformers final rule can be found at: http://www1.eere.energy.gov/buildings/appliance_standards/commercial/distribution_transformers_finalrule.html

MIA was not completed as part of a rulemaking. 42 U.S.C. 6291-6317. For minimum performance requirements prescribed by EISA 2007, DOE did not estimate total industry conversion expenses because a MIA was not completed as part of a rulemaking. Pub. L. 110-140.

Additional investments necessary to meet these potential standards could have significant impacts on manufacturers of the covered products. However, DOE has limited data on the importance of these other regulated products for manufacturers of conventional cooking products and microwave ovens. Differences in market shares and manufacturing processes of other regulated products for each manufacturer could cause varying degrees of burdens on these manufacturers. Therefore, DOE only estimated the cost of compliance to meet other energy conservation standards for regulated products if DOE had published a final rule.

13.8.3.3 Refrigerant Phase-out

In 1987, the United Nations Environment Programme (UNEP) adopted the Montreal Protocol on Substances that Deplete the Ozone Layer (“Montreal Protocol”), which regulates the phase-out of ozone-depleting substances through a collaborative and international effort. In 1988, the United States ratified the Montreal Protocol and thus committed to the phase-out.

In 1990, the Clean Air Act was amended to include Title VI, “Stratospheric Ozone Protection,” to implement the Montreal Protocol. (42 U.S.C 7671, et seq.) Title VI mandated the phase-out by 2020 of HCFC refrigerants for use in new air-conditioning systems. (42 U.S.C. 7671d) Title VI, however, also authorized the United States Environmental Protection Agency (EPA) to accelerate this date if certain criteria were met, (42 U.S.C. 7671e) and EPA subsequently adopted a rule on December 10, 1993 to require the phase-out of HCFC refrigerants for use in new equipment by 2010. 58 FR 65018. R-22, a refrigerant currently used by manufacturers of heating, ventilation, and air-conditioning (HVAC) systems, is an HCFC refrigerant. Phase-out of this refrigerant could have a significant impact on manufacturing, performance, and cost of HVAC equipment. Many of the same manufacturers that produce conventional cooking products and microwave ovens also manufacture equipment that utilizes R-22 refrigerant. These manufacturers will need to convert their manufacturing process and designs to meet the refrigerant requirements in addition to energy conservation standards.

13.8.3.4 Restriction of Hazardous Substance Directive

According to manufacturers, the Restriction of Hazardous Substance Directiveⁱ (RoHS) will have some global impact on manufacturing of electrical and electronic equipment. Under the directive, all manufacturers are banned from placing on the European Union market new electrical and electronic equipment containing more than agreed-upon levels of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyl and polybrominated diphenyl ether flame retardants. Although there is no Federal regulation on RoHS, California has passed SB 20: Electronic Waste Recycling Act of 2003. Under this law, California limits the amount of hazards substances included in the RoHS directive that can be sold in California.

ⁱ Further information about RoHS can be found at http://eur-lex.europa.eu/LexUriServ/site/en/oj/2003/l_037/l_03720030213en00190023.pdf

In addition, several northeastern states have placed a ban on any product that contains more than 1 ounce of mercury (a substance listed in RoHS). This primarily affects mercury-based gas valves found in commercial and residential conventional cooking products. Manufacturers of conventional cooking products have said that these bans and RoHS will have some impacts in the way the electronic components in the cooktops and ovens are incorporated into the design. Currently, these manufacturers have electronic components in the cooktop and oven designs that contain substances banned by the RoHS and mercury limit passed by northeastern states. However, manufacturers do not anticipate these restrictions will significantly impact the cooking products industry as a whole.

A significant worry to manufacturers is the uncertainty about the future of RoHS. One manufacturer stated that California's resumption of the RoHS initiative demonstrates the ease with which any state could selectively choose to ban its products. One manufacturer stated that there are number of exemptions found in RoHS which must be periodically renewed by the EU. Manufacturers use a number of these exempted substances in their products and are not sure if the exemptions will be renewed. Lastly, confirming RoHS-compliance will place additional testing burdens on manufacturers.

Most manufacturers interviewed for this rulemaking are already compliant with the RoHS directive. The most significant cumulative regulatory burden for gas cooking appliance manufacturers is a state-by-state restriction on mercury^j, which affects the gas valves used in their appliances. Most gas cooking appliance manufacturers have already eliminated mercury switches or already have plans in place to do so. However, all appliance manufacturers are concerned about potential restrictions of other hazardous substances in the future, such as fire protection materials, which could be costly to remove from existing products.

13.8.3.5 International Energy Conservation Standards

Canada does set energy conservation standards for cooking products. However, these standards are less stringent than those of the United States. Manufacturers stated their concern that Canada will begin to regulate products at the provincial level. Canada doesn't have Federal pre-emption clauses for efficiency standards like the United States, so province-by-province standards could create a patchwork of standards and result in even greater testing costs.

DOE surveyed foreign regulatory and non-regulatory programs, identifying Korea's e-standby program, Australia's standby program, and Japan's Top Runner Program. All of them aim to meet or exceed the goals of the International Energy Agency (IEA)'s One-Watt program to lower standby power consumption below 1 W for microwave ovens.^k Korea's e-standby program currently has a voluntary labeling program for microwave ovens with less than 1 W of standby power. The program is currently transitioning to a mandatory 1 W maximum standby limit by the year 2010. Australia has plans to implement a mandatory 1 W standard by the year

^j For example, the Interstate Mercury Education & Reduction Clearinghouse (IMERC) is a coalition of Northeast states coordinating the banning of products containing mercury, see <http://www.newmoa.org/prevention/mercury/imerc.cfm>

^k IEA Energy Information Centre, Standby Power Use and the IEA "1-Watt Plan" <http://www.iea.org/textbase/subjectqueries/standby.asp>

2012. In accordance with Japan's Top Runner Program, Japanese appliance manufacturers made a voluntary declaration to reduce standby power consumption of microwave ovens without a timer as close to 0 W as possible and that of microwave ovens with a timer to 1 W or lower.

13.8.3.6 International Test Procedures

Currently, manufacturers of conventional cooking products are principally impacted by foreign regulation due to the need to use a separate test procedure for foreign markets. Depending on the country where the regulation is from, manufacturers must use a separate test procedure for exported products. Manufacturers often have to contract foreign laboratories to conduct tests at the foreign locations.

13.9 CONCLUSIONS

The following sections summarize the different impacts for the scenarios DOE believes are most likely to capture the range of impacts on conventional cooking products and microwave oven manufacturers as a result of new energy conservation standards. DOE also notes that while these scenarios bound the range of most plausible impacts on manufacturers, there potentially could be circumstances which cause manufacturers to experience impacts outside of this range.

13.9.1 Conventional Cooking Products Industry

To assess the lower end of the range of potential impacts for the conventional cooking products industry, DOE considered a scenario in which the industry gross margin percentage in the base case is preserved in the standards case (*i.e.*, the markup is held constant for all products at all TSLs). Thus, a manufacturer is able to fully pass on any additional costs due to standards and maintain the percentage margin between COGS and manufacturing selling price. Thus, if unit sales remain constant, the gross margin in absolute dollars will increase after a standard comes into effect.

To assess the higher end of the range of potential impacts for the conventional cooking products industry, DOE considered the scenario reflecting the preservation of industry gross margin in absolute dollars. Under this scenario, DOE assumed that the industry cannot pass on all additional costs due to efficiency-related changes (*i.e.*, the markup decreases for all TSLs in the standards case.) Thus, the absolute gross margin is held constant. This means the percentage difference between manufacturer production cost and selling price will decrease in the standards case compared to the base case and the gross margin percentage will be lower. As a result, the industry will make the same gross margin in absolute dollars post-standard in a scenario with constant shipments but the industry will also have a lower INPV since the gross margin percentage is eroding.

Electric Cooktops

At TSL 1, the impact on INPV and cash flow for electric cooktops is zero. At this level, DOE assumed both electric coil and smooth cooktops would have the same efficiency level as the baseline. Therefore, no impacts are reported at TSL 1.

At TSL 2 and TSL 3, the impact on INPV and cash flow varies depending on manufacturers' ability to maintain gross margins as a percentage of revenues constant as the manufacturing product cost (MPC) increases as a result of standards. DOE estimated the impacts in INPV at TSL 2 and TSL 3 to range from -\$2 million to -\$11 million, or a change in INPV of -0.55 percent to -3.17 percent. At this level, the industry cash flow would decrease by approximately 13 percent, to \$17.1 million, compared to the base-case value of \$19.6 million in the year leading up to the standards. DOE does not expect significant impacts at TSL 2 and TSL 3 because the investments needed to conform to the standards are relatively small compared to overall SG&A and R&D annual costs. In addition, product price increases would benefit manufacturers if they can fully pass along MPC increases to customers. However, overall INPV would decline in all scenarios at these standard levels because, according to manufacturers, the research and engineering costs needed to achieve these levels would exceed the relatively small capital expenditures and incremental costs at this standard level.

At TSL 4, the impact on INPV and cash flow will vary significantly depending on the manufacturers' ability to maintain a constant gross margin percentage as MPCs increase due to standards. DOE estimated the impacts in INPV to range from approximately positive \$78 million to -\$385 million, or a change in INPV of 21.76 percent to -107.13 percent. At this level, the industry cash flow decreases by approximately 178 percent, to -\$15.3 million, compared to the base-case value of \$19.6 million in the year leading up to the standards. At this TSL, if manufacturers are able to maintain their gross margin as a percentage of revenues, the impacts of higher manufacturing costs would be negated by the increases in total revenues. However, if manufacturers can only maintain their absolute dollar gross margin, then the impacts at TSL 4 would completely erode manufacturers' profits. According to manufacturers, the energy savings at this level are not economically justified because both consumers and manufacturers will experience negative impacts. Consumers would experience significantly higher prices, while manufacturers will experience decreased profits, lower revenues, and much higher R&D costs.

Gas Cooktops

At TSL 1, TSL 2, and TSL 3, the impact on INPV and cash flow varies depending on manufacturers' ability to fully maintain their gross margins as the MPCs increase as a result of the standards. These TSLs are equivalent to the elimination of standing pilot lights. DOE estimated the impacts in INPV at TSL 1, TSL 2, and TSL 3 to range from -\$5 million up to -\$12 million, or a change in INPV of -1.73 percent up to -4.11 percent. At this level, the industry cash flow decreases by approximately 19 percent, to \$13.7 million, compared to the base case value of \$17.0 million in the year leading up to the standards. Since more than 90 percent of the equipment being sold is already at or above this level (*i.e.*, most products do not have standing pilot lights), those manufacturers that do not fall below the efficiency levels specified by TSL 1, TSL 2, and TSL 3 will not have to make additional modifications to their product lines to conform to the new energy conservation standards. DOE expects the lower end of the impacts to be reached, which indicates that industry revenues and costs will not be significantly negatively impacted as long as manufacturers can maintain their gross margin as a percentage of revenues.

Analysis shows that although the elimination of standing pilot lights may not significantly impact large manufacturers, small manufacturers that rely on revenues from these products will be significantly impacted. In MIA interviews, all manufacturers of standing pilot-

equipped gas appliances expressed concern about the potential elimination of standing pilots. Two small businesses, which both focus solely on cooking appliances, produce standing pilot-equipped products which comprise nearly half of their total annual gas product shipments and which they consider to be a differentiator from their larger, more-diversified competitors. While all these manufacturers also make comparable cooking appliances with electronic ignition systems, these two small businesses are likely to be disproportionately impacted by a ban on standing pilot ignition systems. DOE contacted both manufacturers multiple times to better understand the potential business impact of a standing pilot ban. While standing pilot ignition systems are a differentiator, gas cooking products made by these manufacturers are also differentiated by non-standard unit widths and other features. Thus, while the potential elimination of standing pilot lights would decrease, other differentiators, notably non-standard unit sizes, would remain.

At TSL 4, the analysis shows that the impact on INPV and cash flow continues to vary significantly depending on the manufacturers' ability to pass on increases in MPCs to the customer. DOE estimated the impacts in INPV at TSL 4 to range from approximately positive \$28 million to -\$99 million, or a change in INPV of positive 9.88 percent to -34.45 percent. At this level, the industry cash flow decreases by approximately 39 percent, to \$10.3 million, compared to the base case value of \$17.0 million in the year leading up to the standards. At this level, the component switch also carries substantial redesign costs. Sealed burners affect the design of the entire cooktop, making product conversion and capital conversion costs much larger than a simpler component switch. At this TSL, if manufacturers can maintain their gross margin as a percentage of revenues, the impacts of higher manufacturing costs would be negated by the increases in total revenues. However, if manufacturers can only maintain their absolute dollar gross margin, then the impacts of TSL 4 would significantly erode manufacturers' profits.

Electric Ovens

At TSL 1, the projected impact on INPV and cash flow for electric ovens is zero. At this level, DOE assumed both electric standard and self-cleaning ovens would have the same efficiency level as the baseline. Therefore, DOE reported no impacts at TSL 1.

At TSL 2 and TSL 3, the impact on INPV and cash flow varies depending on manufacturers' ability to maintain gross margin as a percentage of revenues as the MPCs increase as a result of standards. DOE estimated the impacts in INPV at TSL 2 and TSL 3 to range from -\$8 million to -\$19 million, or a change in INPV of approximately -.98 percent to -2.43 percent. At these levels, the industry cash flow would decrease by approximately 13 percent, to \$37.8 million, compared to the base-case value of \$43.5 million in the year leading up to the standards. DOE does not expect significant impacts at TSL 2 and TSL 3 because the investments needed to conform to the standards are relatively small in comparison to overall SG&A and R&D annual costs. In addition, product cost increases would benefit manufacturers if they can fully pass along MPC increases to customers.

At TSL 4, the analysis shows that impacts on INPV and cash flow would vary significantly depending on the manufacturers' ability to maintain gross margin as MPCs increase due to standards. DOE estimated the impacts in INPV to range from approximately -\$9 million to -\$471 million, or a change in INPV of -1.17 percent to -59.07 percent. At this level, the

industry cash flow would decrease by approximately 205 percent, to -\$45.9 million, compared to the base-case value of \$43.5 million in the year leading up to the standards. At this level, the increase in efficiency also carries substantial redesign costs. Forced convection and reducing conduction losses affect the design of the entire cavity, making product conversion and capital conversion costs much larger than a simpler component switch. In addition, if manufacturers can maintain their gross margin as a percentage of revenues, the impacts of higher manufacturing costs would be relatively small. However, if manufacturers can only maintain their absolute dollar gross margin, then the impacts of TSL 4 would decrease the INPV of the industry by close to half.

Gas Ovens

At TSL 1 and TSL 2, the impact on INPV and cash flow varies depending on manufacturers' ability to fully maintain their gross margins as the MPC increases as a result of standards. These TSLs are equivalent to the elimination of standing pilot lights from gas cooking products. DOE estimated the impacts in INPV at TSL 1 and TSL 2 to range from a -\$7 million up to -\$10 million, or a change in INPV of -1.56 percent up to -2.10 percent. At this level, the industry cash flow decreases by approximately 11 percent, to \$24.7 million, compared to the base case value of \$27.7 million in the year leading up to the standards. Since more than 80 percent of the equipment being sold is already at or above this level (*i.e.*, most products do not have standing pilot lights), those manufacturers that do not fall below the efficiency levels specified by TSL 1 and TSL 2 would not have to make additional modifications to their product lines to conform to the new energy conservation standards. DOE expects the lower end of the impacts to be reached, which indicates that industry revenues and costs are not significantly negatively impacted as long as manufacturers can maintain their gross margin as a percentage of revenues. The analysis shows that although the elimination of standing pilot lights may not significantly impact large manufacturers, small manufacturers that rely on revenues from these products would be impacted significantly.

At TSL 3, the impact on INPV and cash flow continues to vary depending on the manufacturers' ability to pass on increases in MPCs to the customer. DOE estimated the impacts in INPV at TSL 3 to range from approximately -\$6 million to -\$41 million, or a change in INPV of -1.36 percent to -8.68 percent. At this level, the analysis shows that the industry cash flow decreases by approximately 29 percent, to \$19.8 million, compared to the base case value of \$27.7 million in the year leading up to the standards.

At TSL 4, the impact on INPV and cash flow varies significantly depending on the manufacturers' ability to pass on increases in MPCs to the customer. DOE estimated the impacts in INPV at TSL 4 to range from approximately -\$46 million to -\$182 million, or a change in INPV of -9.91 percent to -38.74 percent. At this level, the analysis shows that the industry cash flow decreases by approximately 198 percent, to -\$27.1 million, compared to the base case value of \$27.7 million in the year leading up to the standards. At this TSL, if manufacturers can maintain their gross margin as a percentage of revenues, the projected increase in total revenues negates the impacts of higher manufacturing costs. However, if manufacturers can only maintain their absolute dollar gross margin, then the impacts of TSL 4 would significantly erode manufacturers' profits.

13.9.2 Microwave Ovens Industry

To assess the lower end of the range of potential impacts for the microwave oven industry, DOE considered the scenario reflecting the preservation of gross margin percentage. As production cost increases with efficiency, this scenario implies manufacturers will be able to maintain gross margins as a percentage of revenues. To assess the higher end of the range of potential impacts for the microwave oven industry, DOE considered the scenario reflecting preservation of gross margin in absolute dollars. Under this scenario, DOE assumed that the industry can maintain its gross margins in absolute dollars after the standard effective date. The industry would do so by passing through its increased costs to customers without increasing its gross margin in absolute dollars.

TSL 1 represents an improvement in cooking efficiency from the baseline level of 0.557 EF to 0.586 EF. At TSL 1, the impact on INPV and cash flow varies greatly depending on the manufacturers and their ability to pass on increases in MPCs to the customer. DOE estimated the impacts in INPV at TSL 1 to range from less than \$45 million to -\$200 million, or a change in INPV of 3.06 percent to -13.75 percent. At this level, the industry cash flow decreases by approximately 18 percent, to \$69.3 million, compared to the base-case value of \$84.9 million in the year leading up to the standards.

TSL 2 represents an improvement in cooking efficiency from the baseline level of 0.557 EF to 0.588 EF. At TSL 2, the impact on INPV and cash flow would be similar to TSL 1 and depend on whether manufacturers can fully recover the increases in MPCs from the customer. DOE estimated the impacts in INPV at TSL 2 to range from \$118 million to -\$388 million, or a change in INPV of 8.11 percent to -26.64 percent. At this level, the industry cash flow decreases by approximately 23 percent, to \$65.4 million, compared to the base-case value of \$84.9 million in the year leading up to the standards.

TSL 3 represents an improvement in cooking efficiency from the baseline level of 0.557 EF to 0.597 EF. At TSL 3, the impact on INPV and cash flow continues to vary depending on the manufacturers and their ability to pass on increases in MPCs to the customer. DOE estimated the impacts in INPV at TSL 3 to range from approximately \$238 million to -\$679 million, or a change in INPV of 16.37 percent to -46.60 percent. At this level, the industry cash flow decreases by approximately 27 percent, to \$61.5 million, compared to the base-case value of \$84.9 million in the year leading up to the standards.

TSL 4 represents an improvement in cooking efficiency from the baseline level of 0.557 EF to 0.602 EF. At TSL 4, DOE estimated the impacts in INPV to range from approximately \$270 million to -\$1,171 million, or a change in INPV of 18.53 percent to -80.42 percent. At this level, the industry cash flow decreases by approximately 104 percent, to -\$3.4 million, compared to the base-case value of \$84.9 million in the year leading up to the standards. At higher TSLs, manufacturers have a harder time fully passing on larger increases in MPCs to the customer.

Due to the similarities in design requirements to meet each TSL, the results for each TSL are dependent on the ability of manufacturers to pass along increases in costs and the additional conversion costs. The engineering analysis assumes that each TSL adds an additional component switch-out. For example, to reach TSL 2, manufacturers must switch the fan in

addition to switching the power supply required to meet TSL 1. The high conversion costs associated with these switches drive INPV negative if incremental costs are only partially passed along to consumers. If the incremental costs are fully passed along to consumers, which manufacturers stated was unlikely due to fierce competition in the industry, the higher purchase prices are enough to overcome the high product conversion and capital conversion costs, thereby making INPV positive. The magnitude of the positive cash flow impact under the preservation of gross margin percentage scenario and the negative cash flow impact under the preservation of gross margin (absolute dollars) scenario depends on the incremental cost of standards-compliant products. The higher the relative cost, the larger the impact on operating revenue and cash flow in the years following the effective date of the standard. Since higher TSLs correspond to higher relative costs, the impacts of the markup scenarios are greater at higher TSLs.

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